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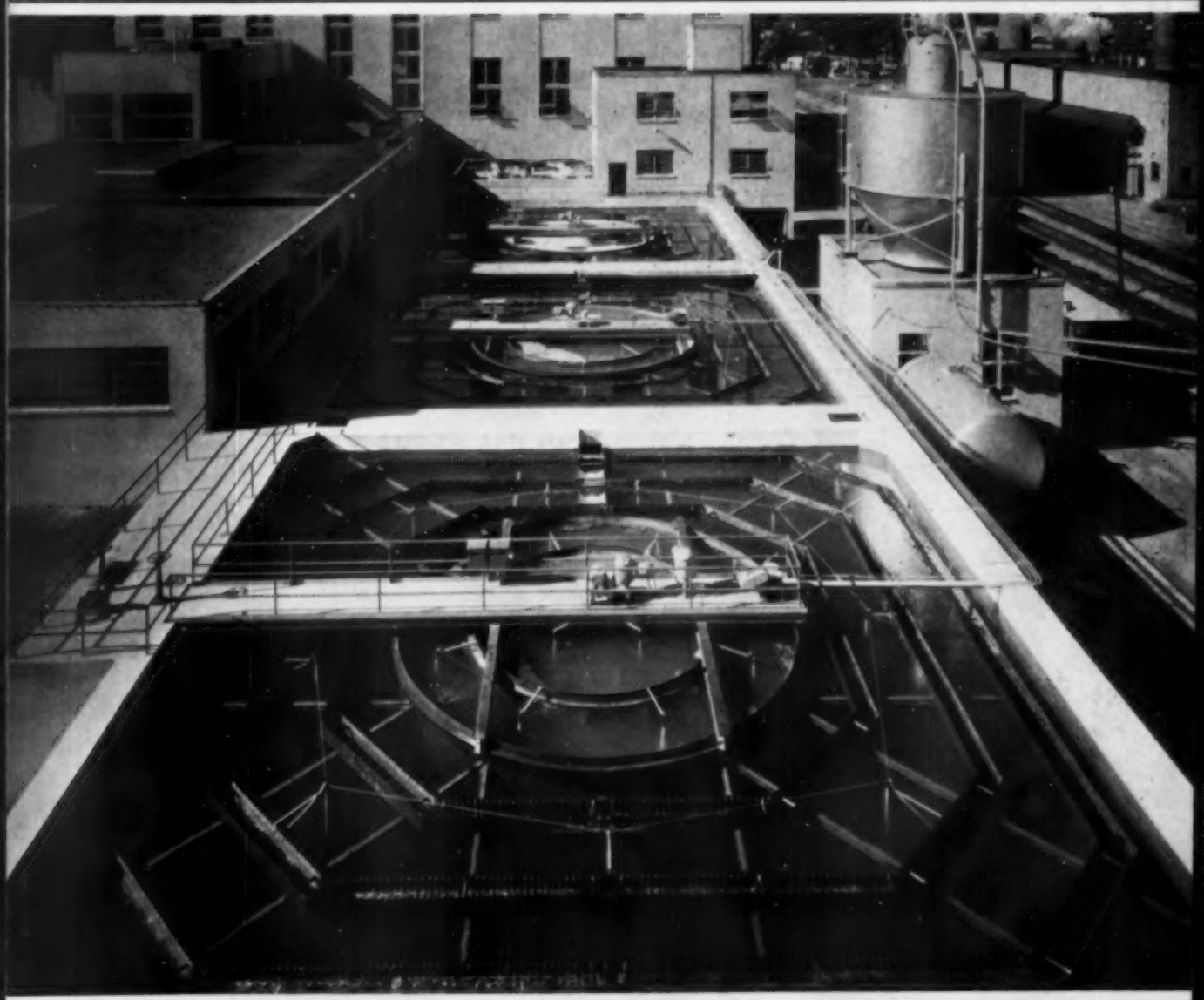
WATER SUPPLY • INDUSTRIAL WASTE TREATMENT • SEWAGE DISPOSAL



Orlando, Fla. - Water Plant Expansion

JULY 1955

WATER YOUR PLANTS AND WATCH THEM GROW!

Today, water is as basic to industrial development as it always has been to agriculture. Since thriving industry is essential to the growth and prosperity of the community, a water supply system capable of sustaining a high rate of industrial expansion is a prime concern of the community.

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This pipe retains its initial high carrying capacity throughout an exceptionally long life, is low in initial cost, and requires very little, if any, maintenance. More important still, its record for unfailing, trouble-free service is unexcelled

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East Orange, New Jersey

Sales Offices: Chicago, Ill. • Columbia, S. C. • Denver, Col. • Detroit, Mich. • Hartford, Conn. • Kansas City, Mo.

Pressure • Water • Sewer • **REINFORCED CONCRETE PIPE** • Culvert • Subaqueous

Now! Do All Three Clearing Jobs with One HOMELITE Chain Saw

New Versatile Attachments for Model 17 Chain Saw Will Clear Everything from Brush and Brambles to Four-Foot Trees. Save Money on Equipment and Job Time by Following These Three Steps:

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2 Clear Small Trees and Saplings — In a jiffy the new Homelite Clearing Attachment converts your Homelite Model 17 Chain Saw to a fast-cutting, light-weight clearing tool. Plunge cuts or plunge bucks and makes limbing an easy job. Open guide rail prevents pinching and binding . . . takes the backache out of knocking the small ones down and cutting them up for haulage.

3 Now For The Big Stuff — With the standard guide bar you can bring down trees over four feet in diameter. The Homelite Model 17 is light in weight, easy to handle and packed with more horsepower per pound than any other one-man chain saw ever developed. (3.5 hp — 22 lbs.)

With its new attachments the Homelite Model 17 Chain Saw will give you the versatile, fast-cutting, dependable performance you need to save time and make real profits from clearing. Ask your Homelite Representative for a free demonstration or write for information.

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Carryable Pumps • Generators • Blowers • Chain Saws

WATERSPHEROID

The 500,000-gal. Horton Waterspheroid, above, is the first ever built. It was erected for municipal service at Northbrook, Illinois.

. . . . the shape of things to come in elevated storage

Several years ago, we introduced the Watersphere® — a boldly new type of elevated water tank. Now we are introducing the WATERSPHEROID — a "king-size" version of the Watersphere. Although spheroidal instead of spherical in shape, the Waterspheroid provides all the inherent advantages of the Watersphere — *dependable gravity pressure water supply; striking appearance; minimum surface area to maintain; a base that takes up minimum ground space and yet can be used for storage.*

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INDUSTRIAL WASTE TREATMENT

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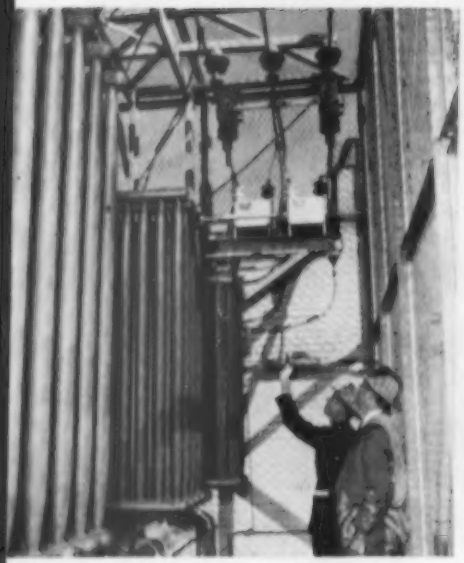
LITTLE MIAMI SEWAGE TREATMENT PLANT
—first step in Cincinnati, Ohio's program to provide modern sewage treatment and disposal facilities. Consulting Engrs.: Havens and Emerson. Gen. Contractor: James McHugh Constr. Co., Inc.



FACT: Reliable electrical service starts at this city-owned substation, adjacent to the plant. Three 333-kva, single-phase Westinghouse transformers step down utility power from 13.2 kv to 480 volts.

FACT: Service continuity on the entire electrical system stems from this Westinghouse switchboard, distributing at 480 volts. Air circuit breakers protect the main circuit and 10 branch feeders.

FACT: Westinghouse "De-ion®" circuit breaker panelboards at key distribution points protect plant's services. Westinghouse dry-type transformer, top, reduces voltage for lighting and instruments.

FACT:

Westinghouse distribution equipment serves Cincinnati's new sewage treatment plant

ELECTRICAL SYSTEM DESIGNED TO MATCH LITTLE MIAMI PLANT'S ULTIMATE CAPACITY OF 30,000,000 GALLONS A DAY

FACT: Dependable power in Cincinnati's Little Miami Sewage Treatment Plant is assured by a coordinated installation of three 333-kva transformers, a 480-volt switchboard, lighting and power panelboards, dry-type transformers and motor control . . . all matched for operating simplicity and plant efficiency.

FACT: Positive protection of valuable equipment is provided by using Westinghouse circuit breakers throughout the distribution system . . . and circuit breakers are safe.

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Specify ALCO Welded Steel Pipe . . .

for **STRENGTH**

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ECONOMY

DURABILITY

ALCO Steel Pipe is stronger . . . it is less affected by vibration, shock or impact and has greater strength for a given wall thickness than any other material used for transmission pipe.

Greater Efficiency . . . ALCO Steel Pipe is watertight, gas-proof and even vacuum-proof. The smooth, coal-tar enameled interior surface gives maximum rate of flow.

ALCO Steel Pipe is economical. Initial cost is low. The long sections of pipe mean faster installation. Shipping costs are low, too.

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Locked-in lining prevents sewer disintegration

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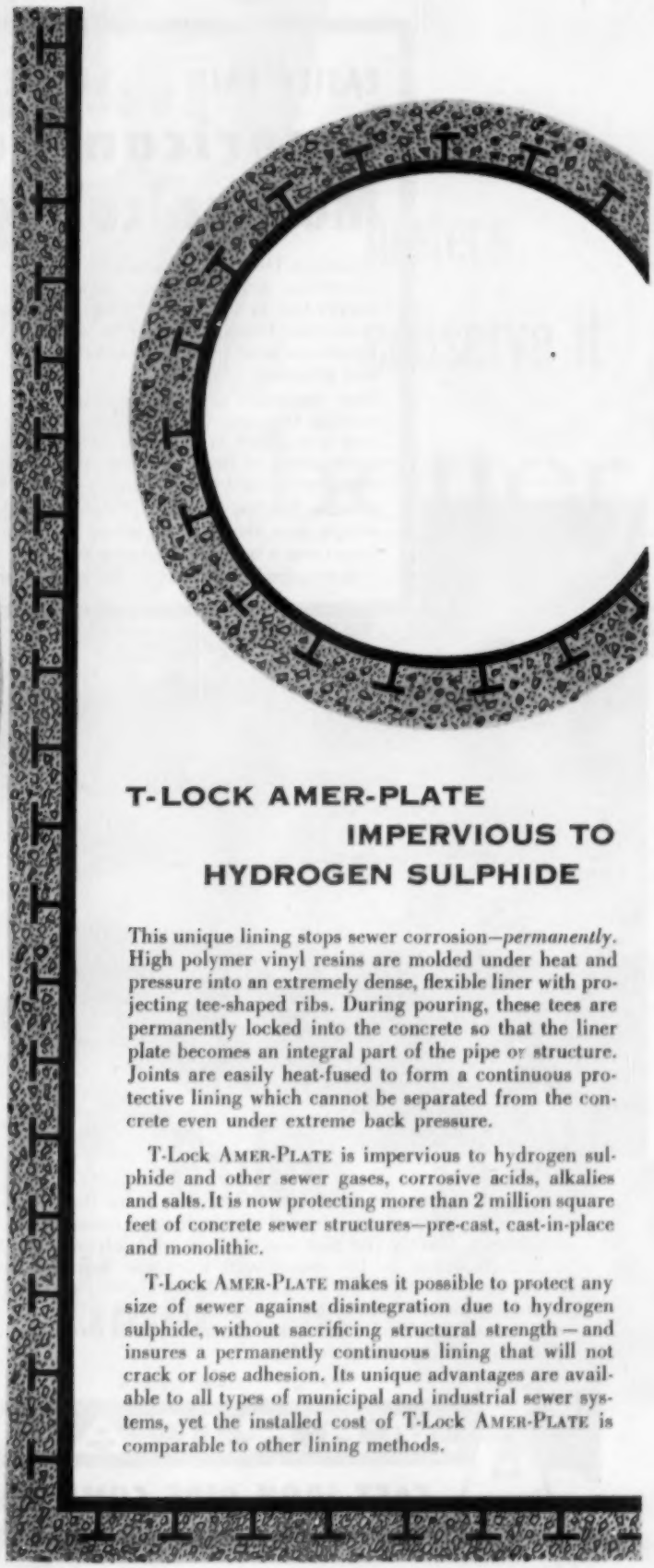

T-LOCK AMER-PLATE IMPERVIOUS TO HYDROGEN SULPHIDE

This unique lining stops sewer corrosion—*permanently*. High polymer vinyl resins are molded under heat and pressure into an extremely dense, flexible liner with projecting tee-shaped ribs. During pouring, these tees are permanently locked into the concrete so that the liner plate becomes an integral part of the pipe or structure. Joints are easily heat-fused to form a continuous protective lining which cannot be separated from the concrete even under extreme back pressure.

T-Lock AMER-PLATE is impervious to hydrogen sulphide and other sewer gases, corrosive acids, alkalies and salts. It is now protecting more than 2 million square feet of concrete sewer structures—pre-cast, cast-in-place and monolithic.

T-Lock AMER-PLATE makes it possible to protect any size of sewer against disintegration due to hydrogen sulphide, without sacrificing structural strength — and insures a permanently continuous lining that will not crack or lose adhesion. Its unique advantages are available to all types of municipal and industrial sewer systems, yet the installed cost of T-Lock AMER-PLATE is comparable to other lining methods.

EASILY LAID . . . VERSATILE . . . RUGGED

American Double-X Mechanical Joint Pipe

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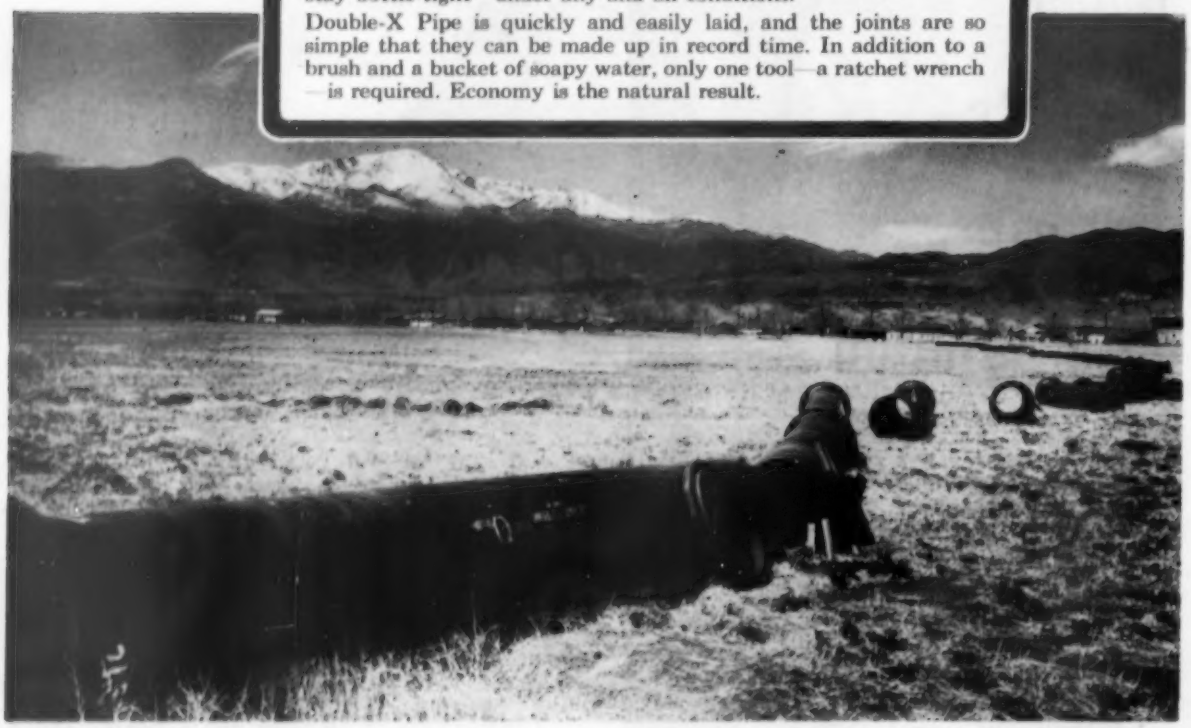
The American Double-X joint is scientifically designed with a stuffing box into which an endless ring gasket is compressed by a cast iron gland. It allows ample deflection as well as expansion and contraction of the line without leakage. Rugged Double-X Joints stay bottle-tight—under any and all conditions.

Double-X Pipe is quickly and easily laid, and the joints are so simple that they can be made up in record time. In addition to a brush and a bucket of soapy water, only one tool—a ratchet wrench—is required. Economy is the natural result.



THE wide range of sizes centrifugally cast by the American Cast Iron Pipe Company—from 2" through 48"—assures that American can furnish exactly the pipe and fittings your job requires. Each size is manufactured to the exact wall thickness required for specific operating conditions. Let American's long-experienced staff of skilled engineers, metallurgists, and craftsmen help you solve your next pipe installation problem. Write today for free booklet describing American Double-X Mechanical Joint Pipe.

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Badger Water Meters

Badger Meter Mfg. Co.
Milwaukee 45, Wisconsin

"Measuring the water of the world for 50 years"

AMVIT JOINTED CLAY PIPE IS WATERTIGHT
PREVENTS *Costly Ground Water Infiltration*

Municipal Authority of the
BOROUGH OF BETHEL, PENN.

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The Chester Engineers

Contractor
Diulus Construction Company, Inc.

"Now, for the first time watertight sewer lines are economically feasible. Ground water infiltration can be controlled and prevented," says E. T. Davis, Partner, The Chester Engineers, Pittsburgh, Pennyslvania. "We selected Amvit Jointed Vitrified Clay Pipe on an 8-inch sanitary sewer line for the Municipal Authority of the Borough of Bethel, Penn., because the Amvit Joint proved infiltration proof."

The Amvit Joint is a true mechanical joint, based on the ball and socket principle. The diameter of the spigot ring is somewhat larger than the largest diameter of the bell ring. When the two ends are pushed together the rings are in constant compression of more than 22 psi. Water cannot force its way in or out.

Prevent costly infiltration. Stop pumping and treating thousands of gallons of ground water. Amvit Jointed Clay Pipe is infiltration proof and root proof.

For more information, write or call American Vitrified Products Company, National City Bank Building, Cleveland, Ohio, or our office nearest you.

Testing Amvit Jointed Clay Pipe are from, (L. to R.) E. T. Davis, Partner, The Chester Engineers; Joseph Diulus, President, Diulus Construction Company, Inc.; C. K. Stroh, Partner, The Chester Engineers; and Tracy Price, American Vitrified Products Company.

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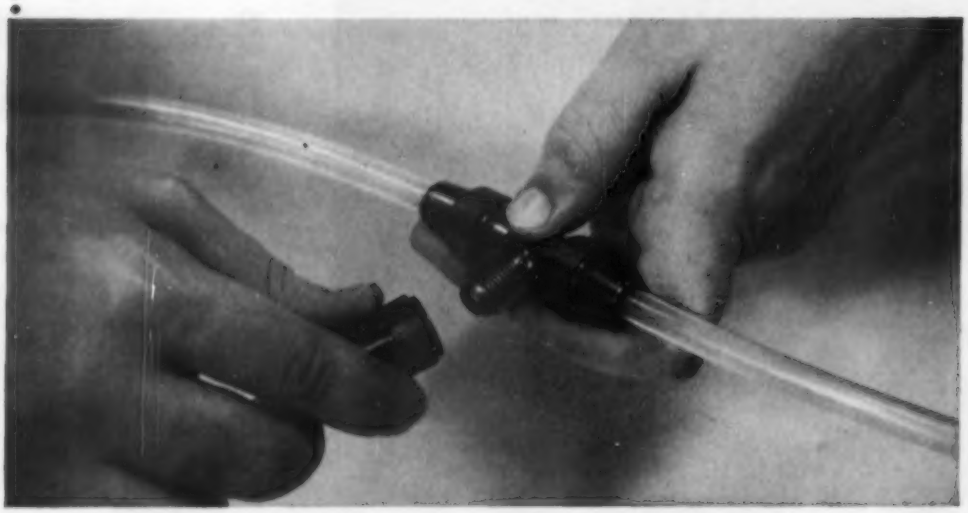

MILLS PLASTIC I (SARAN)

FLEXIBLE – for air, oil and water lines, lubricating systems, food handling, beverages, vitamin oils and drugs, electrical raceways, etc.

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SEMI-RIGID – for use where corrosion is a major problem, including transportation of brine, sour crude, acids, natural gas. Non-toxic; recommended for food processing. Also excellent for electrical raceways.

Now Continental brings you *four* different types of plastic pipe. Our experts are ready and eager to help you pick the kind and size best suited to your purpose. In addition, we are now making the complete line of plastic fittings formerly maufactured by Tenco, Inc., of Winona, Minn. Whether you are handling water, food or drug products, chemicals, sour crude, salt water or natural gas, we can give you the best in plastic pipe and fittings at one call. May we hear from you soon? No obligation, of course.

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Remember, it's the life of a meter that counts — not the price

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Cuts digging day to 3 hours with powerful ½-yard Hydro-Trencher

Here the Hydro-Trencher digs a ditch for a new sewer line. Hydraulic stabilizer blade also acts as a backfiller blade. By simply turning the bucket around you can convert the trencher to a swing loader. Hydraulic trip loading bucket is also available.

This Oliver 88WT Hydro-Trencher is working on a city sewer project—locating a manhole 8-feet deep through a 2½ by 5-foot street opening.

By hand this is a full day's work for three men. The Hydro-Trencher cut the time to three hours! Working in cramped quarters is duck soup for the 88WT. Powerful hydraulic down pressure, 170° bucket rotation and maneuverable, dual-circuit control let you dig in the most inaccessible places... work delicately around pipes, foundations without fear of damage.

With the 88WT you can slice through rocky soil, roots, hard Clay—dig all the way to 12 feet. The two complete hydraulic systems on the Hydro-Trencher give you unbelievable control—let you perform any two operations at once without loss of pressure.

Owners of Hydro-Trenchers enthusiastically report savings in time and money on many jobs formerly requiring hand labor or larger equipment. Get the low-down on the most profitable, maneuverable trencher in the field—the Oliver 88WT. See your Oliver Industrial Distributor for a demonstration.

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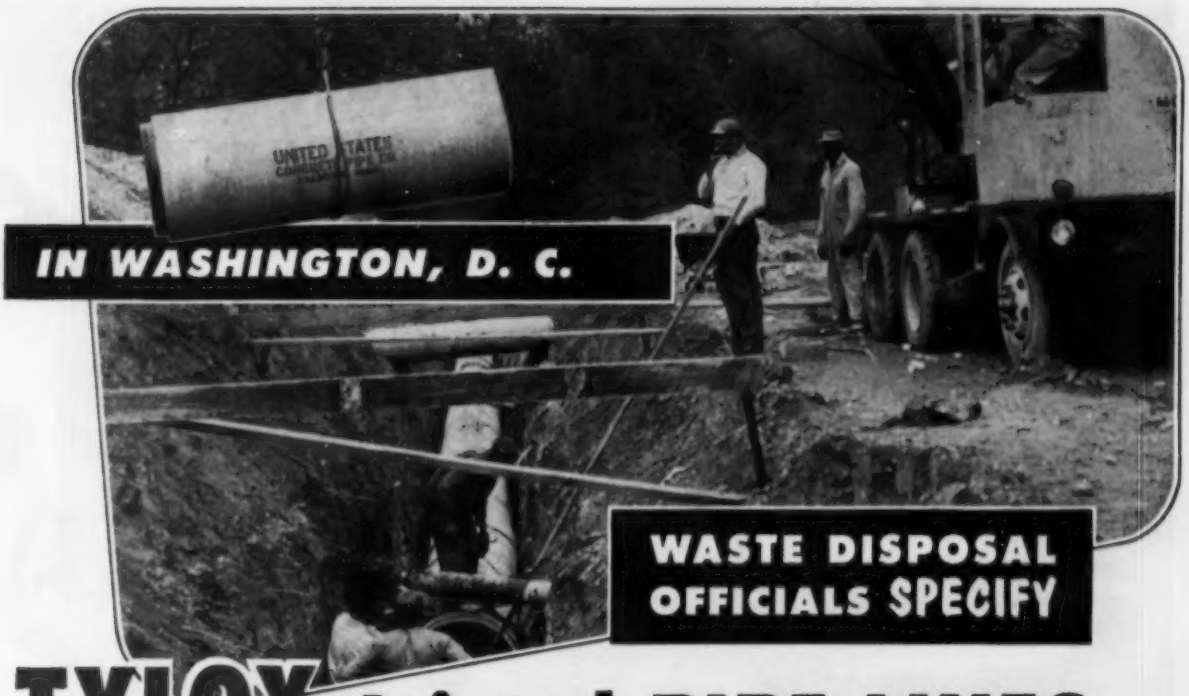
400 West Madison Street, Chicago 6, Illinois

OLIVER

a complete line of industrial wheel and crawler tractors



TYLOX-Jointed PIPE LINES

TO REDUCE COST—LENGTHEN LIFE OF NEW SEWERS AND DRAINS

More and more city, state and Federal officials concerned with sewerage and drainage construction are specifying TYLOX Rubber Joints for the pipe lines they plan. Washington, D. C.'s new sewers at Kenilworth and Deane Avenues is only typical of this trend. When its designers called for this champion of all sewerage and drainage pipe-jointing materials, they gave the public "most for their waste disposal tax dollar" these three ways:

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NO JOINT LEAKS—TYLOX Gaskets seal "rubber-tight" under compression. Water can't pass in or out of the pipe to cause pollution or bring on problems with roots or sediment. And naturally-resilient TYLOX **flexes** to protect joints from rupture due to surface loads or soil stresses.

NO CORROSION—Made of specially compounded rubber, TYLOX Joints are immune to sewerage or industrial waste acids and alkalies. TYLOX outlasts the pipe itself.

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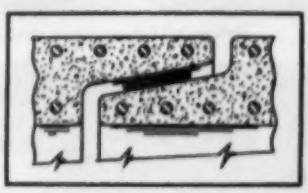
LOCATION: Kenilworth & Deane Avenues, Washington, D. C.

ENGINEERS: Sanitary Engineering Dept., Government of the District of Columbia.

CONTRACTOR: J. L. McIlvane Co., Washington, D. C.

PIPE: Vitrified Plate-Lined Concrete Pipe, manufactured by United States Concrete Pipe Company, Cleveland, Ohio.



This rubber-tight mechanical seal stays tight "for the life of the line."

5008

Write today for more details and illustrated performance histories on TYLOX. Read the facts, and assure fast-working, leak-proof and non-deteriorating joints for your pipe jobs with a specification for TYLOX RUBBER JOINTS.

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KENT, OHIO

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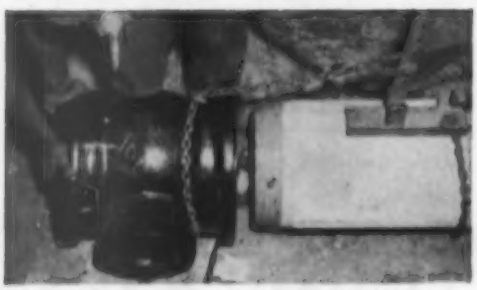
Water works men say
Installation time cut beyond all expectations!*
. . . and you'll get peak performance, too, with Transite Pressure® Pipe and the NEW Ring-Tite® Coupling

Easy handling, fast assembly

Installation follows digger closely



Ring-Tite Fittings, too—You can join pipe directly to fittings, valves and hydrants embodying the Ring-Tite design . . . no special tools needed, no poured joints

Water works engineers have found that with Transite Pressure Pipe and the Ring-Tite Coupling, installed costs are lower, performance is higher. Contractors can install it faster, and once installed, it maintains its high flow capacity year after year . . . keeps pumping costs low . . . may mean smaller pipe size to start.

Both Transite Pressure Pipe and Ring-Tite Coupling are made of asbestos-cement. Strong and durable, this material cannot rust, is highly resistant to corrosion, will not tuberculate.

With Ring-Tite, installed costs are less—assembly follows the digger closely. The special coupling design permits quick, easy alignment. To assemble, rubber rings are simply popped into grooves. Then lubricated pipe-ends slide in under the rings easily, smoothly, and surely.

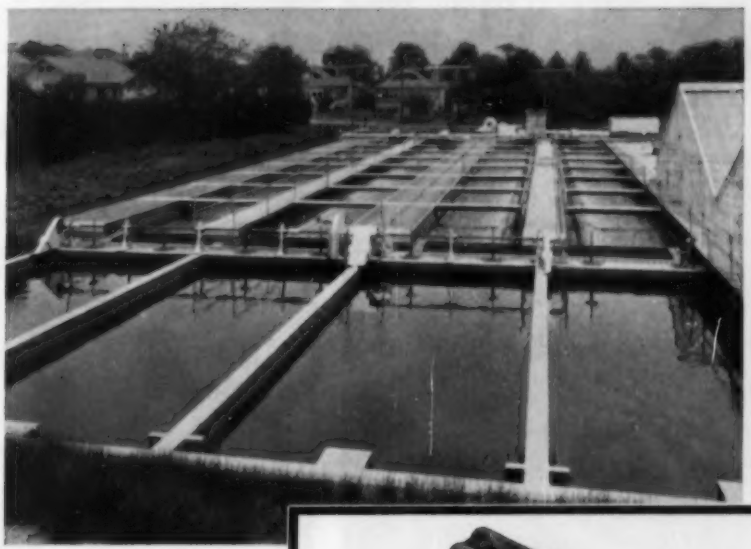
Pipe ends stop positively and are positioned accurately—with ends automatically separated within the coupling. This gives the line flexibility to withstand shock and vibration, relieves line stresses, permits conformance to curves.

For further information write Johns-Manville, Box 60, New York 16, N. Y.

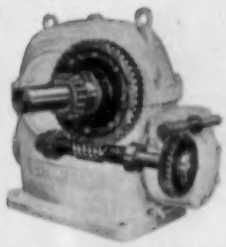
*Excerpt from actual field report: "Exceeded by far the installation speed anticipated under job conditions."

Johns-Manville TRANSITE PRESSURE PIPE
WITH NEW RING-TITE COUPLING

How will your judgment on SANITARY ENGINEERING EQUIPMENT look after 15 years?



FOR 15 YEARS, the Link-Belt chain on final tank Straightline Collectors at this Collingswood (N.J.) activated sludge plant rendered dependable service, running 24 hours per day, *without replacement.* Straightline collectors in primary tanks have been in service for 24 years without replacement. Clearness of effluent may be judged by reflection of the drive machinery in final tanks in foreground.



ENCLOSED DRIVES. All types have sturdy gray iron housings, anti-friction bearings and precision gears for long trouble-free operation.

CHAIN. Made of Promal, the longer-wearing pearlitic malleable iron, has toughness, strength, high yield point, high resistance to abrasion.

SPROCKETS. Flint-Rim wheels have smooth, file hard, wear-resisting teeth, assuring maximum life.

LINK-BELT equipment is sturdily designed to last for decades

REMEMBER this when developing specifications and interpreting quotations on your water, sewage or industrial waste treatment system. It pays to give thoughtful analysis to design and equipment which will assure long life with little maintenance. Such scrutiny will also tell you why — in cities large and small . . . in plants of all types — Link-Belt installations continue to deliver top efficiency at lowest operating cost for many years.

Link-Belt offers you a broad line of *quality* sanitary equipment — including screens, collectors, mixers and complete conveying and power transmission equipment. In fact, Link-Belt pioneered such life-lengthening features as Flint-Rim sprockets and Promal chain.

With this wide choice of equipment, you also put Link-Belt's many years of technical experience to work on your needs. These two are your assurance of sturdy design . . . close attention to all construction details . . . a thoroughly tested, tried and proved system.

Next time you're faced with water, sewage or industrial waste treatment problems, call your nearest Link-Belt office. Our engineers will work with yours . . . with your chemists and consultants to provide you with the finest in modern treatment equipment.

LINK-BELT

SANITARY ENGINEERING EQUIPMENT

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

13,027

Chosen in the West. "Century" Pipe is shown as it is installed at Lake Almanor, Calif. The piping will be a part of the water system at Lake Almanor Country Club Estates.

Chosen in the East. This photograph shows "Century" Pipe being laid in the hard, rock-filled soil of New England near South Hadley Falls, Mass. Today, more and more value-conscious communities are specifying this durable, long-lasting pipe.

13 miles of long-lasting pipe! Pictured here is part of a 13-mile installation of "Century" Pipe at the Lakewood Water District near Tacoma, Washington. Made of two practically indestructible materials, asbestos and cement, "Century" Pipe assures *extra* years of low-cost service.

Across America, K&M "Century"® Pipe is Stabilizing Pumping Costs

Because K&M "Century" Asbestos-Cement Pipe is non-tuberculating, highly resistant to corrosion, and immune to electrolysis, the diameter of its bore never changes. Consequently, there is *no creeping up of pumping costs.*

Durable "Century" Pipe, formed on a smooth steel mandrel, has a smooth interior surface offering a minimum of friction. The Williams and Hazen Constant "C" is conservatively placed at 140. As it is relatively light in weight, machinery for handling up to and including 12″ pipe sizes is not needed.

Leakage problems also vanish! Permanently tight joints are made possible by the use of "Century" Simplex Couplings. The pipe also meets the A.W.W.A., A.S.T.M., and Federal specifications for asbestos-cement pressure pipe.

Write for FREE booklet, "Mains Without Maintenance." We'll also be glad to help you with any installation problem in your specific operation.

KEASBEY & MATTISON

COMPANY • AMBLER • PENNSYLVANIA

K&M best in asbestos®

Chardon, Ohio solves water problems

WITH A

BJ SUBMERSIBLE

Difficult problems overcome—yet water costs only 3½ cents per 1000 gallons!

The town of Chardon (pop. 2,478) in Gauga County, Ohio, faced these difficult problems in solving a primary water supply pump selection:

1. The proposed pump site was a flood area.
2. The site was on the town's golf course where unsightly structures or pump houses could not mar the landscape.
3. The pump installation would be 1½ miles from the overhead water tower.

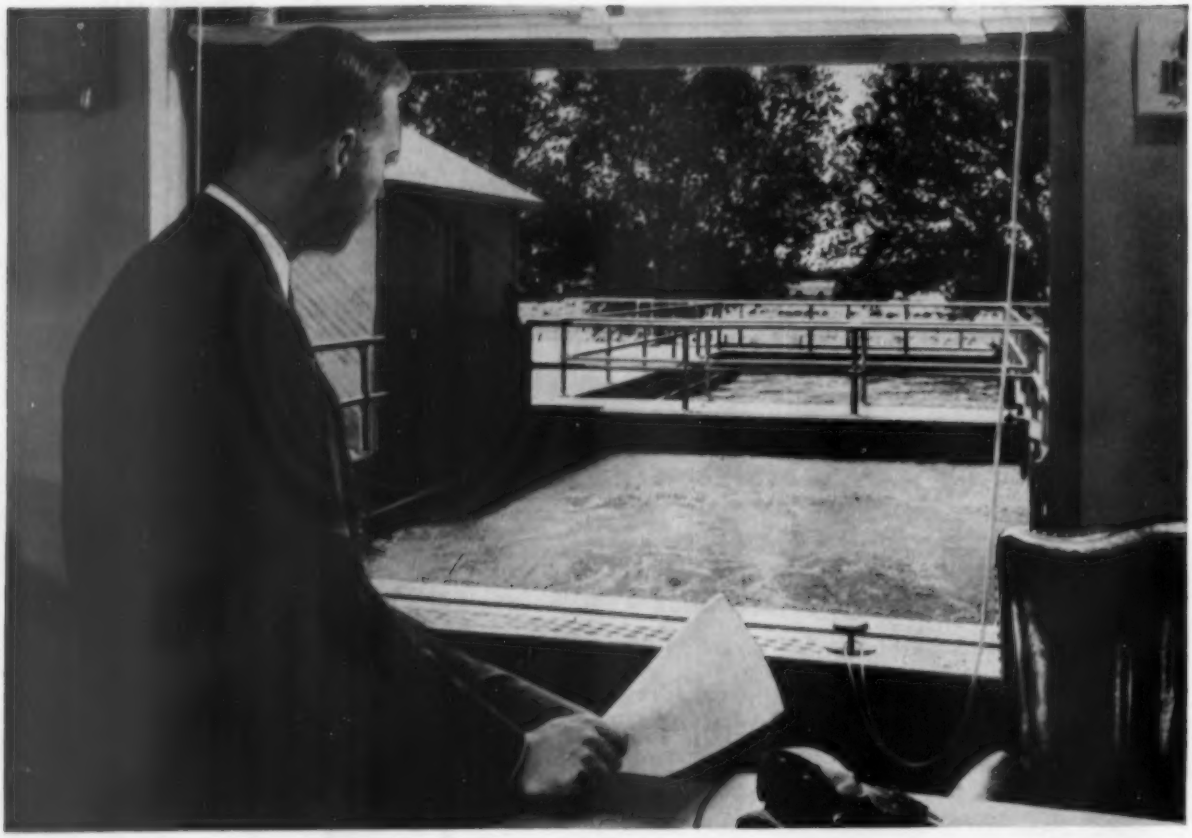
RESULTS TALK!

The Chardon Board of Public Affairs worked with Byron Jackson Co. engineers. A 30 horsepower BJ Subette, capable of pumping 250 gpm against a head of 360 ft., was installed in a simply-constructed pit in the marshy area. Unseen and completely submerged, this single Subette pumps one-half of the town's water supply. It eliminated the need for an unwanted and expensive pump house and solved the dangers of flood-out during high water periods. In addition to solving these difficult installation requirements, the BJ Subette is pumping water at an operating cost of only 3½ cents per 1000 gallons!

The BJ Subette answers primary water supply and booster pumping needs of the smaller municipal user. For larger cities, BJ Submersible models are available in capacities to 20,000 gpm and heads to 1800 ft.
Write for complete information

BJ
SINCE 1872

Byron Jackson Co.
PUMP DIVISION
P.O. Box 2017, Terminal Annex, Los Angeles 54, California
Sales offices in all principal cities



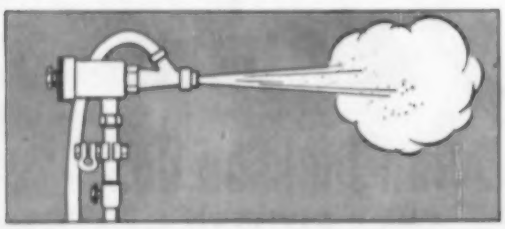
What can you do about sewage odor complaints?

Even the most modern sewage plant often gets complaints from the public. When care, cleanliness and chlorination fail, and you still get sewage odor complaints, what can be done?

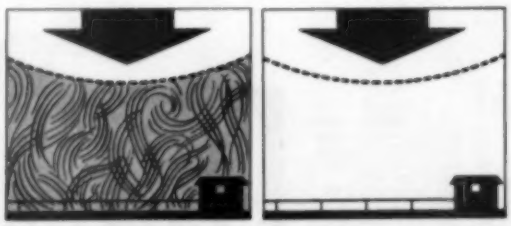
A group of Airkem odor counteractants is solving this problem for sewage plants throughout the country. Application is simple: the odor counteractant is dispersed into the air through air-spray nozzles. Molecular dispersion combines the counteractant with the atmospheric airstream to reduce odors immediately.

Air inversion is often the cause of odor complaints. When atmospheric conditions block off normal odor-escape routes, odors cling to the ground and often develop into a public relations problem. Airkem solves this problem because it covers every dispersion area.

A consultation with Airkem will be completely confidential and there is absolutely no obligation. Call your Airkem representative listed in the phone book or write Airkem, Inc., 241 East 44 Street, New York 17, N. Y.



Airkem air-spray nozzle disperses effective odor counteractant into atmospheric airstream.

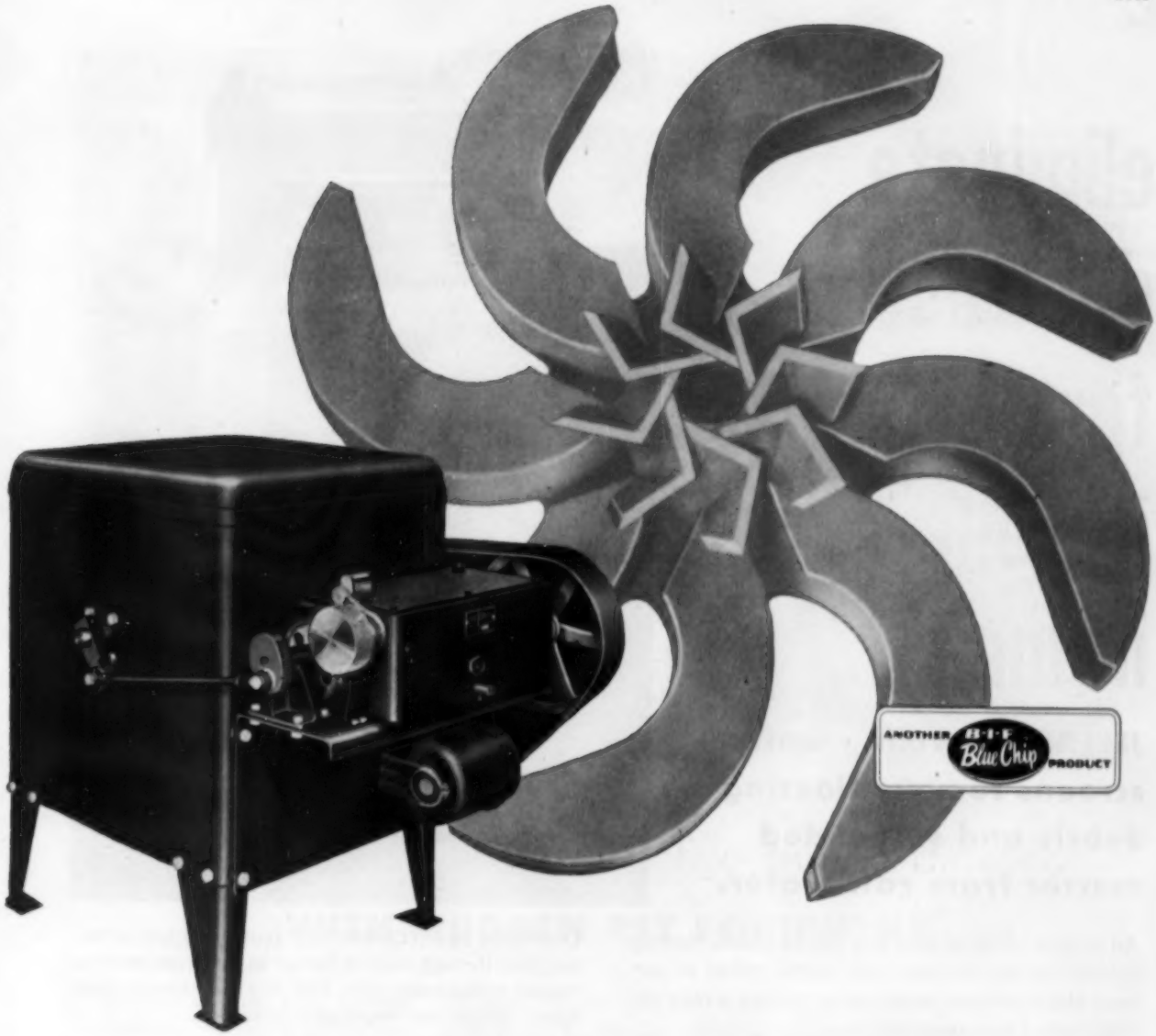


Airkem covers entire dispersion area under air inversion conditions. Counteracts odor immediately.

For Industrial • Municipal • Institutional • Commercial Use

AIRKEM ODOR COUNTERACTANTS

airkem



THE WHEEL OF FORTUNE FOR LIQUID CHEMICAL FEEDING

Because of its unique rotary dipper wheel, the Omega Rotodip Liquid Feeder is the low-cost, low-maintenance answer to many liquid chemical feeding problems. Rotodip sure pays dividends on feeding jobs like these: carbon slurry for taste and odor control . . . liquid alum for coagulation or sulfuric acid for pH control . . . ferric chloride feeding for sewage sludge conditioning. Consider the many advantages which are yours in using a Rotodip: wide-range adjustability (100 to 1) — high repeatable accuracy (within 1%) — complete simplicity (very low on maintenance) — easy adaptability to automatic control systems — direct-reading gallon-by-gallon totalizer.

Send for new Bulletin 65-H12A . . . a detailed description of this accurate and efficient feeder. Omega Machine Co., 350 Harris Avenue, Providence 1, R. I.

OMEGA *THE LAST WORD IN* **FEEDERS**

DIVISION OF B-I-F INDUSTRIES, INC.

BUILDERS IRON FOUNDRY • PROPORTIONEERS, INC. • BUILDERS-PROVIDENCE, INC.

B·I·F METERS FEEDERS CONTROLS

eliminate destructive foreign matter in your influent...

JEFFREY traveling water screens remove floating debris and suspended matter from raw water.

An endless chain of traveling screen panels, moving upward on the entrance side, carries refuse to surface. High pressure water spray washes screen deposits into carry-away trough.

USE—in all plants requiring large volumes of water.

EASY INSTALLATION—Compact unit consists of vertical traveling screen, screen baskets, chain, sprays, guides, drive unit, frame, and semi-enclosed housing.

OPERATING ECONOMY—Enclosed ball bearing motor, anti-friction bearing speed reducer with gears running in oil, non-clog spray pipes with quick-opening valves.

STURDY CONSTRUCTION—Welded steel baskets, steel thimble roller chain, cast iron chilled rollers, cold roll steel head and foot shafts, fine mesh wire screen, ⅜-inch structural steel frame.

COMPLETE PROTECTION—End skirts form seal as baskets pass through boot. Adjacent basket cross members overlap to seal basket joint. End skirt flanges cover chain. Speed reducer has overloaded protection.

Jeffrey's broad experience in design and construction covers all types of sanitation system installations. Hundreds of municipal plants and private industrial plants over the entire nation are Jeffrey-equipped. The Jeffrey line includes:

Bar and Disc Type Screens	FLOCTROLS
Screenings Grinders	Dry Feed Chemical Machines
Grit Collectors & Washers	Biofiltration Plant Equipment
Sludge Collectors	Garbage Grinders
Sludge Elevators	Belt and Spiral Conveyors
Scum Removers	Bucket Elevators
Power Transmission Machinery	Chains and Sprockets

Traveling Water Screens

JEFFREY

Write Sanitation Sales Division.
The Jeffrey Manufacturing Co., Columbus 16, Ohio

CONVEYING • PROCESSING • MINING EQUIPMENT
TRANSMISSION MACHINERY • CONTRACT MANUFACTURING

Behind control building, PFT Floating Cover on 35' digester

At Sykesville, Maryland . . .

A hospital equips for effective sludge digestion

WITH MODERN PFT EQUIPMENT

To meet its own rigid sanitary standards, the Springfield State Hospital at Sykesville, Md. constructed a filter-type sewage treatment plant in 1953. Key features of the plant are the items of PFT equipment installed for effective sludge digestion!

In the 35' digester, a *PFT Floating Cover* was specified for its positive scum submergence and safe utilization of gas. Floating Covers reduce explosion hazards by maintaining gas at positive pressure to prevent the entrance of atmospheric oxygen.

Floating Covers also simplify operations by eliminating the need for fixed levels—additions and withdrawals can be made at times best suited to the overall operation.

In the control room, a *PFT Cover Position Indicator* (Liquidometer) tells the operator at a glance the exact position of the Floating Cover.

The hospital was naturally concerned over the possibility of odor nuisance. To avoid this problem, a *PFT 2" Waste Gas Burner* was installed to burn off safely all excess gas produced in the digester.

As in all its installations, PFT assisted consulting engineers by showing the adaptability of its equipment in meeting specific plant requirements. To further assure successful treatment, PFT instructed plant personnel in the proper operation of its equipment.

Design of plant by / *Whitman, Requardt & Associates, Baltimore, Maryland*

waste treatment equipment exclusively since 1893

P.F.T.

PACIFIC FLUSH TANK CO.
4241 Ravenswood Avenue
Chicago 13, Illinois

PORT CHESTER, N. Y. • SAN MATEO, CALIF. • CHARLOTTE, N. C. • JACKSONVILLE • DENVER

STOP THE CAUSE OF LEAKAGE...*for good!*

By recaulking a leaky bell-and-spigot joint, you are not removing the condition that caused its failure. You still have a rigid joint that might leak again under pipe movement, vibration, other line stresses.

Dresser Bell-Joint Clamps *eliminate this cause* of leakage by sealing the joint with a resilient rubber gasket that absorbs pipe stresses, remains tight for the life of the line.

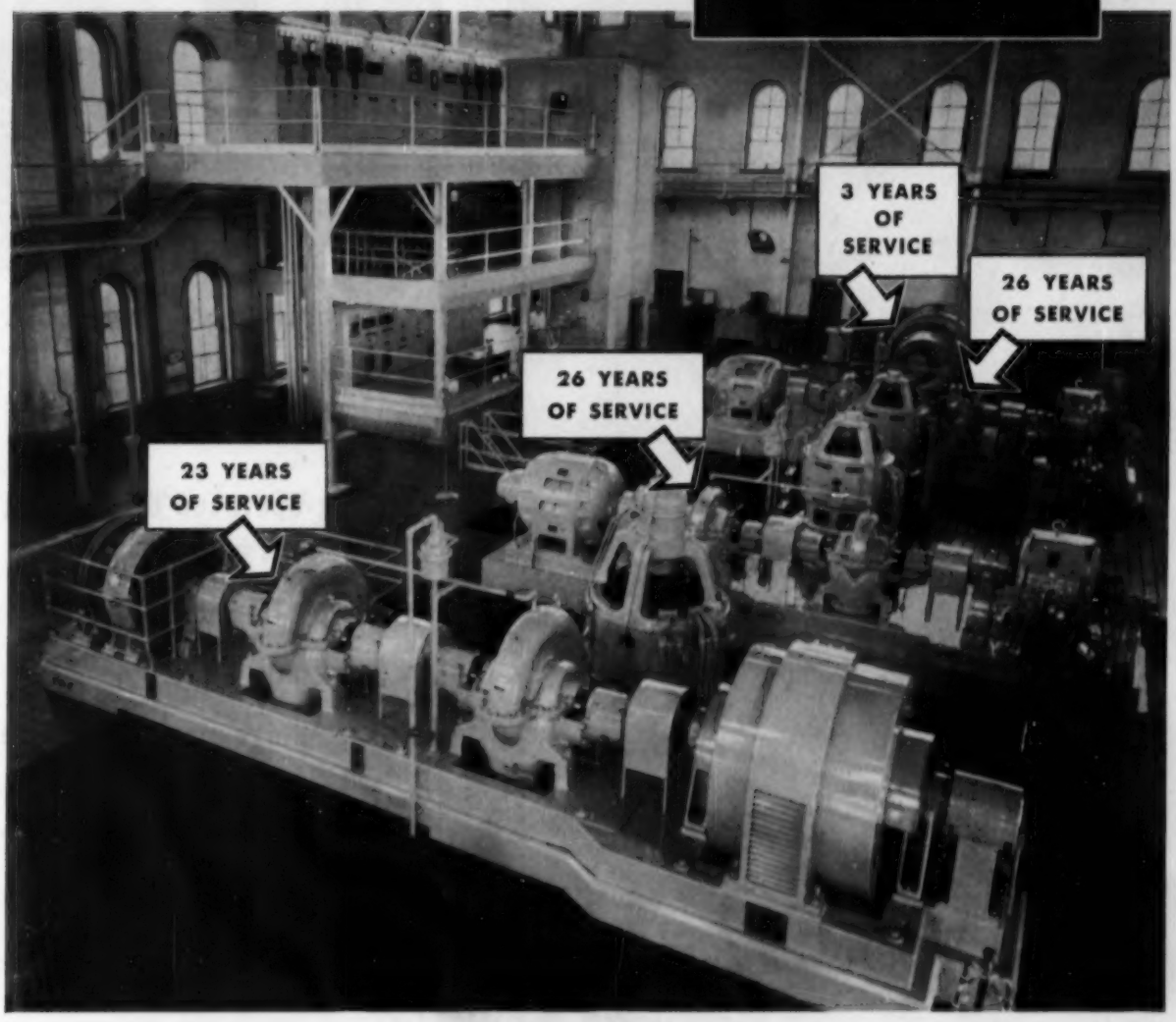
Wherever you have gone to the trouble and expense of uncovering a bell-and-spigot joint—*for any reason*—give it absolute protection against future failure with a Dresser Bell-Joint Clamp, Style 60! Order from your local supplier today, or write us.

DRESSER®
BELL-JOINT CLAMPS

Dresser Manufacturing Division, 69 Fisher Ave., Bradford, Pa. (One of the Dresser Industries). Warehouses: 1121 Rothwell St., Houston; 101 S. Airport Blvd., S. San Francisco. Sales Offices also in: New York, Philadelphia, Chicago, Toronto.

Nashville goes to 100 mgd with

DE LAVAL
CENTRIFUGAL PUMPS



The years of service shown on these De Laval centrifugal pumps tell their own story of dependability and progress. By revising its facilities, the George Reyer pumping station in Nashville has boosted its pumping capacity to 100 million gallons per day.

The De Laval pumps play an integral part in this more efficient operation. For example, the newest De Laval unit handles 40 million gallons per day.

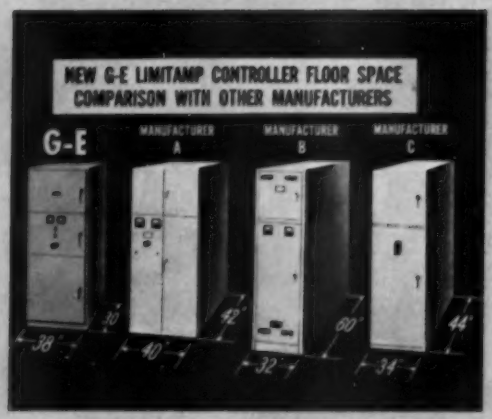
In fact, 80% of all cities in the United States, with a population of 100,000 or over, use De Laval centrifugal pumps. Capacities of De Laval centrifugal water works pumps range from 100 thousand to 100 million gallons per day. Write for your copy of new De Laval Bulletin 824.

DE LAVAL *Centrifugal Pumps*

DE LAVAL STEAM TURBINE COMPANY

824 Nottingham Way, Trenton 2, New Jersey

DL 304



356 SQ. IN. LESS area than next smallest starter.

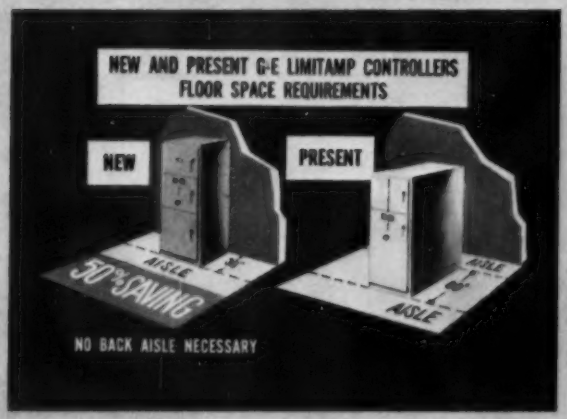
General Electric Announces . . .

NEW Limitamp*

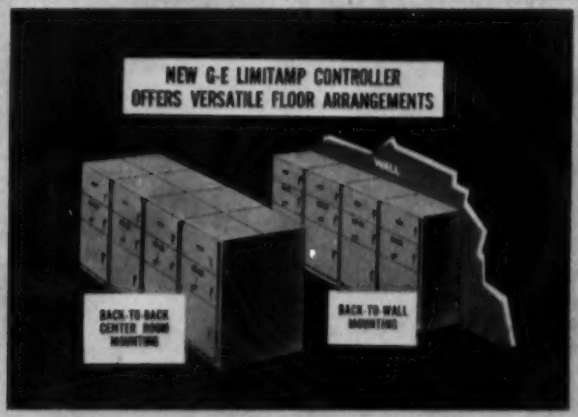
- **Gang-operated disconnect switch on all units**
- **Entirely front connected**
- **30-inch depth**
- **Low-voltage panel hinged to swing out of enclosure**
- **Contactor rolls in or out of cabinet**

NEW DESIGN

INSTALLATION IS SIMPLIFIED. A man can easily enter enclosure to make connections.



OVER 50% SPACE SAVINGS by elimination of back-aisle.



VERSATILE INSTALLATION—units all front connected.

Control saves over 50% floor space

ENTIRELY FRONT CONNECTED, only 30 inches deep, General Electric's all-new Limitamp control offers versatility of installation. New 30-inch depth allows unit to be transported through normal size doorways, and 90-inch height includes bus compartment. Back-to-back, back-to-wall, or mounting as free standing enclosure is now possible.

IDEAL FOR HIGH-VOLTAGE MOTORS, rated 2300-4800 volts and up to 3000 h-p, the new Limitamp control may be applied to squirrel-cage, synchronous, wound-rotor, and multi-speed motors on power systems requiring high interrupting capacity for maximum short-circuit protection.

NEW CONCEPTS IN SAFETY are built into new Limitamp control. Gang-operated disconnect switch, steel barriers between all compartments, enclosed bus compartment and co-ordination of starter assure you of safer high-voltage motor control.

G.E. LIMITAMP STARTERS are co-ordinated to provide maximum protection for equipment and personnel. Co-ordinated circuit components guard against needless fuse blowing, give running overload protection and provide maximum safe-guard against short-circuit damage for starter and equipment.

FOR COMPLETE APPLICATION ENGINEERING service contact your nearest G-E Apparatus Sales office. Write for Bulletin GEA-6331, Section 781-12, General Electric Co., Schenectady 5, New York.

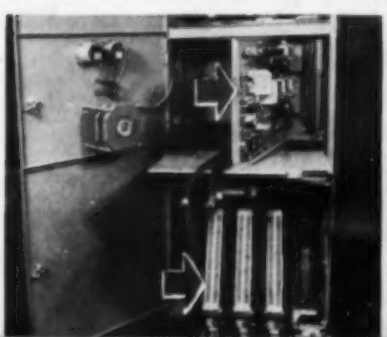
*Trade-mark of General Electric Company

Progress Is Our Most Important Product

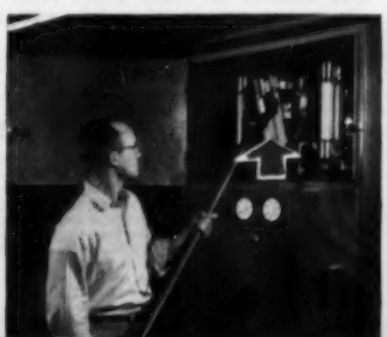
GENERAL ELECTRIC

SIMPLIFIES INSTALLATION AND MAINTENANCE

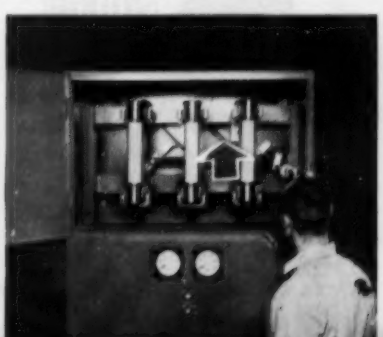
MAINTENANCE IS EASY. Low-voltage panel swings out, contactor rolls out.



TYPE EJ-2 CURRENT-LIMITING fuses are safely, quickly replaced within seconds.



SAFE VISUAL CHECK of disconnect switch with fuse compartment door open.



Water rides on a tall tower for better consumer service in Prince Georges County, Md.

Elevated Steel Tanks

by PITTSBURGH • DES MOINES

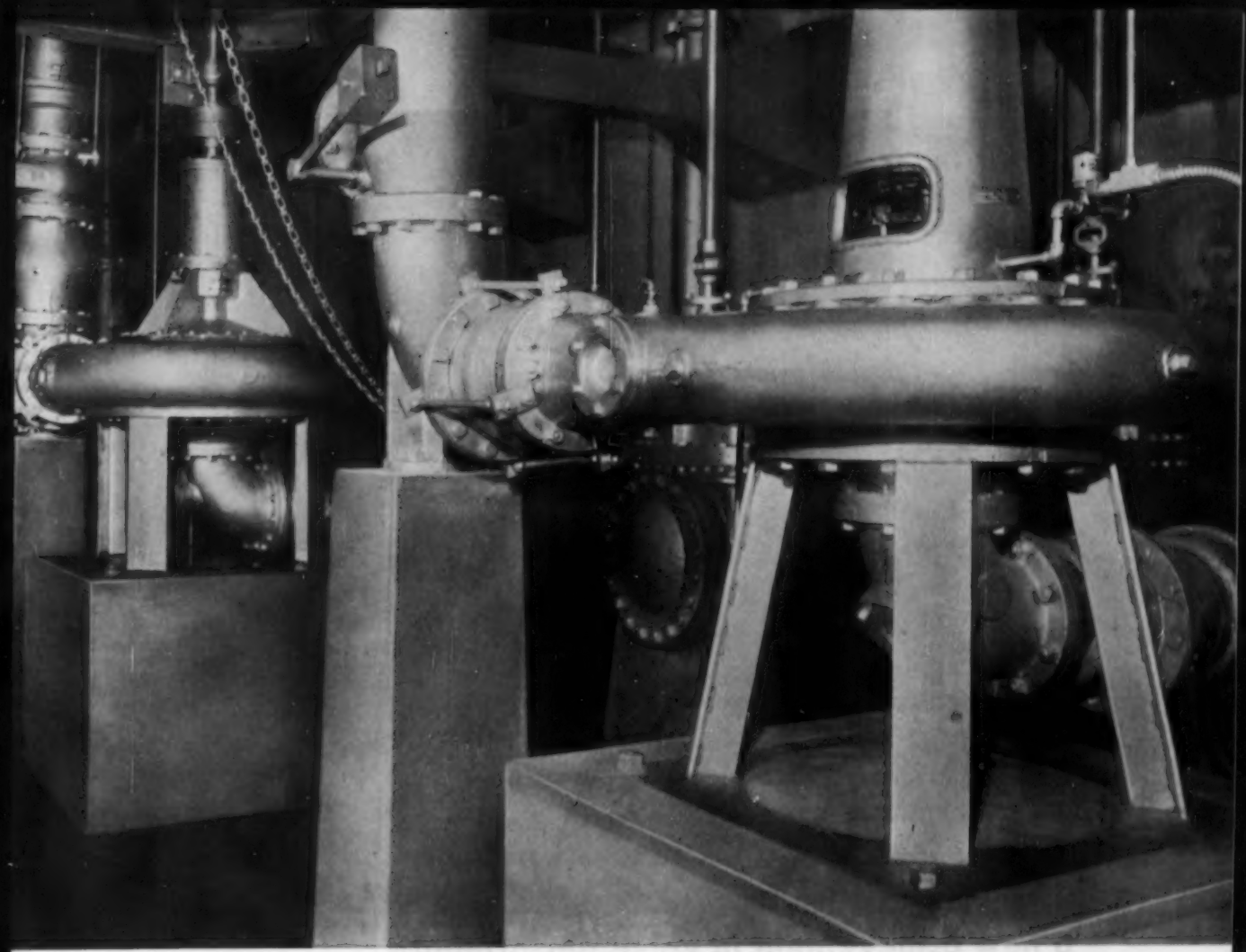
A million gallons of water, 160 ft high in this P-DM elevated steel tank, "rides" on the Washington Suburban Sanitary Commission system at a location distant from the source of supply. A relatively high head range of 47 ft accommodates the variations in supply pressure, so that water may always accumulate during off-peak hours and be available to augment the supply at peak demand periods. Diameter of the tank is 65 ft. • A broad picture of the many Pittsburgh-Des Moines Elevated Steel Tank types is provided in our illustrated 20-page brochure. Write for your free copy.

PITTSBURGH • DES MOINES STEEL CO.

Plants at PITTSBURGH, DES MOINES and SANTA CLARA

Sales Offices at:

PITTSBURGH (25)	3418 Neville Island	DES MOINES (8)	919 Tuttle Street
NEWARK (2)	218 Industrial Office Bldg.	DALLAS (1)	1223 Praetorian Bldg.
CHICAGO (3)	1222 First National Bank Bldg.	SEATTLE	526 Lane Street
LOS ANGELES (48)	6399 Wilshire Blvd.	SANTA CLARA, CAL.	625 Alviso Road



YOU CAN RELY ON YOUR FAIRBANKS-MORSE FIELD ENGINEER . . .

For trash pumps that won't clog

Would you like to cut maintenance costs on your sewage trash pumps 25% . . . 50% . . . even eliminate maintenance costs due to clogging? Call in your Fairbanks-Morse Field Engineer . . . have him give you all the facts on the Fairbanks-Morse Bladeless Impeller Pump . . . the pump that can't clog.

Your Fairbanks-Morse Field Engineer is a pump application specialist . . . can help you select the non-clog trash pump or other sewage plant or water supply pumps that exactly fit your requirements. Because he can recommend from the complete Fairbanks-Morse line, he has a type and size that will solve your problems . . . efficiently and economically.

For complete details, mail the coupon. Fairbanks, Morse & Co., 3601 Kansas Ave., Kansas City, Kan.

FAIRBANKS-MORSE

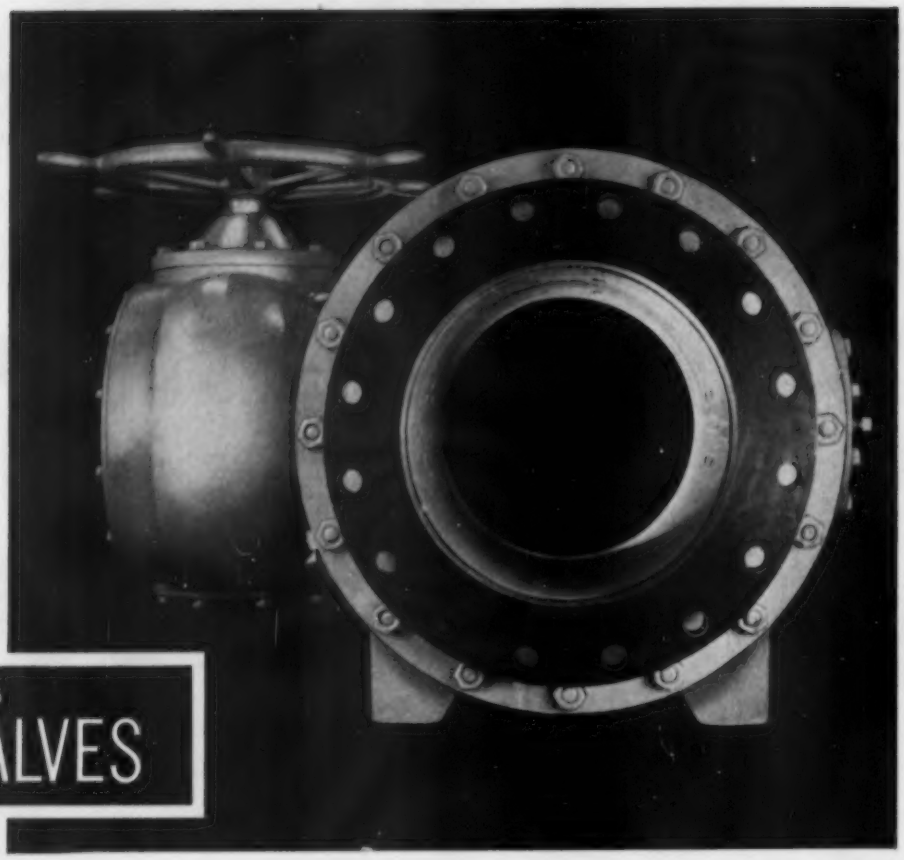
a name worth remembering when you want the best

PUMPS • SCALES • DIESEL LOCOMOTIVES AND ENGINES • ELECTRICAL MACHINERY
RAIL CARS • HOME WATER SERVICE EQUIPMENT • MOWERS • MAGNETOS

FAIRBANKS, MORSE & CO.
Pump Sales Division
3601 Kansas Ave.,
Kansas City, Kansas

☐ Please send me literature on the Fairbanks-Morse Bladeless Impeller Non-Clog Trash Pump.
☐ Have a Fairbanks-Morse Field Engineer call.

Name_____
Title_____
Address_____
City_____ Zone____ State_____



SMS
BALL VALVES

a new achievement in valve performance . . .
STRAIGHT-THROUGH FLOW WITH DROP-TIGHT CLOSURE

For the path of least resistance—the new SMS-Ball Valve has no equal in design or price. When open, the valve is like a straight piece of pipe—nothing to resist flow and create resultant pressure drop, thereby reducing pumping costs. Elimination of turbulence adds to valve and pipe life.

EASE OF OPERATION—Forces required for opening and closing are remarkably low, even under adverse conditions. The tremendous leverage exerted by the operating mechanism affords complete ease of operation. Flow velocity tends to ease closing.

TIGHTNESS OF CLOSURE—Drop-tight closure is obtained by the wedging action of the metal-to-metal seats.

SMS-Ball Valves afford high performance at significant in-place savings. Costs compared to valves giving similar performance are appreciably less. Write for our new Ball Valve folder.

This new valve, as well as our full line of cone and butterfly valves, is backed by over 75 years experience in hydraulic design and research. For full information on your valve problem, check with your local representative, or write to S. Morgan Smith Company, York, Pennsylvania.

Hydraulic Turbines
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HYDRODYNAMICS

Rotovalves
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Free-Discharge Valves
Controllable-Pitch Ship Propellers

S. MORGAN SMITH CO.

AFFILIATE: S. MORGAN SMITH CANADA, LIMITED, TORONTO

Standby...for Action

... the dependability built into Le Roi engines means that you have power when you need it most

The operator of the Le Roi F1500 shown above said, "This engine has surpassed our every requirement for standby power, and has more than paid for itself with dependable, economical, power production when we needed it most."

That's typical of the results experienced by Le Roi engine users everywhere. But you get more than just dependability. You get economy.

For example, Le Roi engines are so compact that you save on installation costs. Volume production and post-war designs give you more horsepower per dollar. Also, because Le Roi engines can use the lowest cost fuels available, savings in operating costs are important, too. We have some engines that have saved taxpayers over $4000 a year for 14 years — others that have saved $7600 in a 10-month period. And so it goes.

You, too, can save your taxpayers' money and still provide them with the services they need, by using Le Roi engines. Sizes range up to 645 hp, or in custom generator sets from 50 to 350 KW. And all Le Roi's operate on natural gas, LPG, gasoline, or no-cost sewage gas. Write us for our latest literature.

E-108

LE ROI *Division of Westinghouse Air Brake Co.*

Milwaukee 14, Wisconsin

PORTABLE AIR COMPRESSORS

TRACTAIR

STATIONARY AIR COMPRESSORS

AIR TOOLS

ENGINES

Sewage Pump Well Elevation Held at 114.5′±3″ Despite Big Variations in Flow

Three of four E-M 200 hp, 1200 rpm Vertical Synchronous Motors with Adjustable-Speed Magnetic Drives at Nut Island Sewage Treatment Plant of the South Metropolitan Sewage System in Quincy, Massachusetts.

E-M Vertical Synchronous Motor and Magnetic Drive Unit for adjustable-speed power transmission to vertical centrifugal pump. The ring element (1) mounted directly on the motor shaft turns at motor speed. The magnet element (2), mounted inside the ring element, has no mechanical connection to the motor . . . torque is transmitted through magnetic flux linkage between ring and magnet. By varying amount of excitation to magnet, pump speed can be precisely controlled.

AMAZINGLY PRECISE CONTROL OF SEWAGE PUMPS OBTAINED WITH E-M ADJUSTABLE-SPEED MAGNETIC DRIVES

One of the critical problems in operating Boston's new Nut Island Sewage Treatment Plant is complete control over the wide daily, weekly or seasonal flow variations. For example, flows may vary from 63 mgd to 249 mgd, with peak loads of nearly 300 mgd during stormy periods.

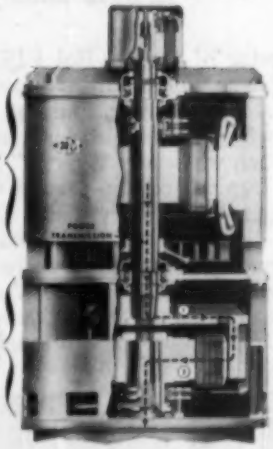
The pump well has to maintain an elevation of 114.5 feet with not more than 3 inches variation, to assure proper levels and flow velocities in the sewage processing channels. Control of the output of the low-lift sewage pumps has to be fast and remarkably accurate.

Use of E-M Adjustable-Speed Magnetic Drives for the low-lift pumps provides the sensitive speed control necessary in maintaining this close command of the pump well elevation.

Pump speed changes are dictated by a well float that actuates the Magnetic Drive through an E-M "Regutron" Control. Pump speed is automatically increased or decreased to maintain precisely the required pump well elevation. The Magnetic Drives are highly important and effective factors in most efficient operation of the Nut Island Sewage Treatment Plant for eliminating pollution in Boston Harbor.

For more information, see your nearest E-M sales engineer. And write direct for a copy of E-M Synchronizer No. 38 which tells the complete story of this outstanding installation.

ELECTRIC MACHINERY MFG. COMPANY
MINNEAPOLIS 13, MINNESOTA



E-M

Specialists in making motors do
EXACTLY WHAT YOU WANT THEM TO

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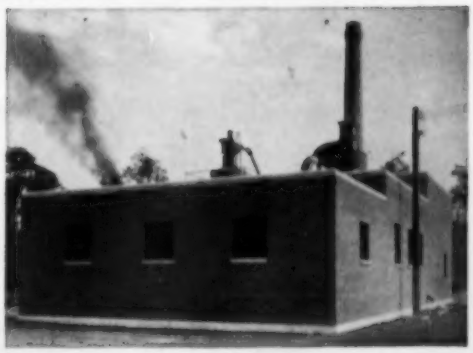


City of SHEBOYGAN WISCONSIN
SEWAGE TREATMENT PLANT
3333 LAKE SHORE DRIVE
"The City of Elms"

January 18, 1955

Mr. C.W.Gordon, Manager
Raymond Division
Combustion Engineering Inc.
1315 North Branch St.
Chicago 22, Ill.

Dear Sir:

In reply to your letter of January 14, 1955, regarding the operation of our Flash Dryer System, please be advised as follows;

Our Flash Dryer System was placed in operation in November 1946, and since that time, we have dried all our sewage sludge with this process.

The total expenditures for repair parts during this period, does not exceed $300.00.

We have during this time, disposed of all of the dried product as a fertilizer.

We are well satisfied with the operation of this phase of sewage treatment, and are pleased to show visitors our installation at all times.

Yours very truly,

Jake A. Klein Supt.

Just mention our name in Sheboygan

Mention it at any rate to Jake Klein, Superintendent of the Sewage Treatment Plant, and he will be glad to show you around. He knows us and knows our equipment. In fact, for almost ten years the Sheboygan plant has been flash drying its digested sewage sludge with C-E Raymond Flash Drying equipment—and *selling its entire output*. During the past year total sales were 905 tons.

Naturally, we're pleased as Punch with Jake's letter reprinted here—but hasten to add we've received many others.

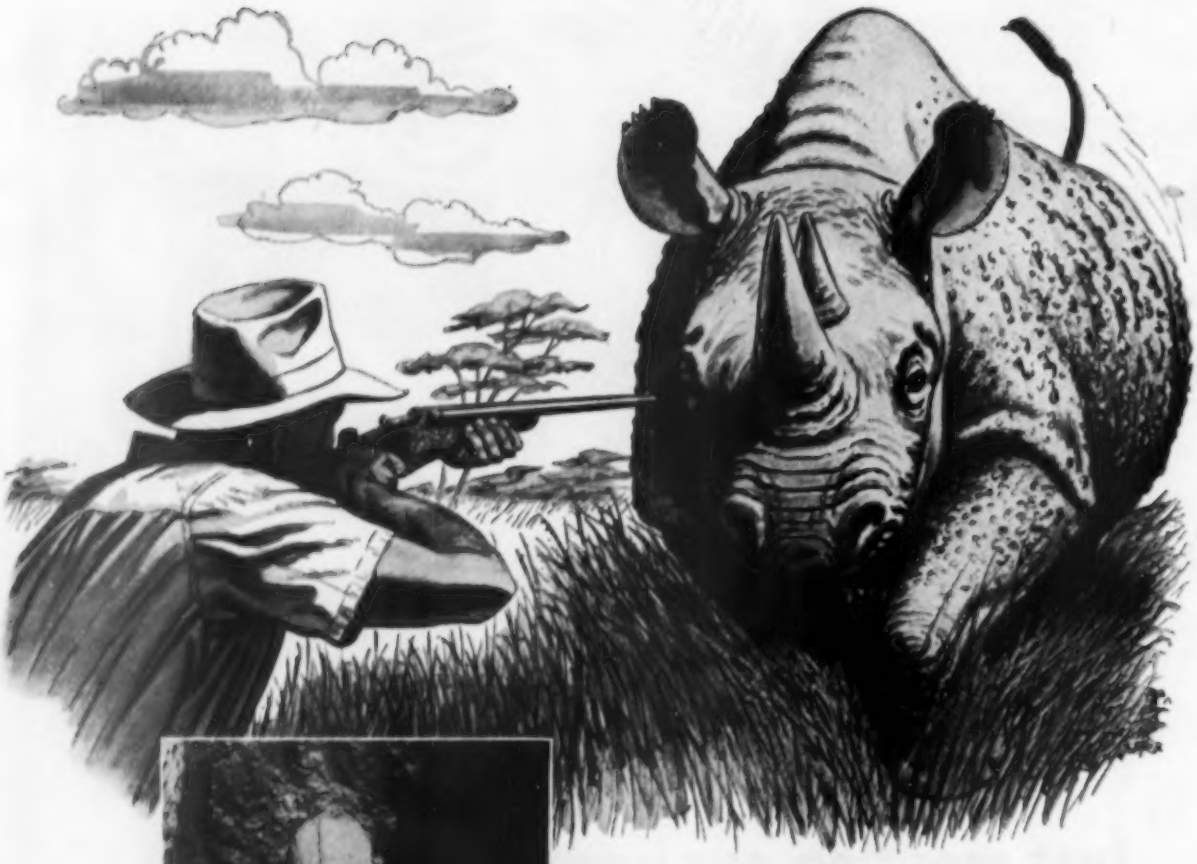
So, if you're thinking of a new disposal plant, investigate the C-E Raymond Flash Drying System. It can incinerate—or dry—or both—alternately or concurrently. We believe we have the best system of sewage sludge disposal. We would like the opportunity to tell you why. B-834

COMBUSTION ENGINEERING
RAYMOND DIVISION
1315 North Branch Street, Chicago 22, Illinois

Eastern Office: 200 Madison Avenue, New York 16, New York • Western Office: 510 West Sixth Street, Los Angeles 14, California

ALSO FLASH DRYING AND INCINERATION SYSTEMS FOR INDUSTRIAL WASTE DISPOSAL

what have they



The rhino lives in wooded, watery districts of Africa and Asia. Its temper is short, its eyesight dim but its scent and hearing are very acute. Though heavy, it is extremely fleet of foot. It feeds mostly at night and its diet is largely vegetarian.

This cast iron main laid in Richmond in 1830 is still functioning after more than a century of service.

MODERNIZED cast iron

in common...

THE RHINO AND CAST IRON PIPE...TOUGHNESS!

The thick, tough hide of the rhinoceros makes it one of the hardest animals to bring down. Toughness is also a dominant feature of CAST IRON PIPE. It serves for centuries.

AND HERE'S THE PROOF: Listed below are some of the many water utilities still using cast iron pipe that was installed a century or more ago.

DEPARTMENT OF WATER AND WATER SUPPLY, City of Albany, New York
ALEXANDRIA WATER COMPANY
Alexandria, Virginia
BUREAU OF WATER, DEPT. OF PUBLIC WORKS, Baltimore, Maryland
PUBLIC WORKS DEPT., WATER DIVISION
Boston, Massachusetts
DEPARTMENT OF PUBLIC WORKS, DIVISION OF WATER, Buffalo, N. Y.
WATER WORKS DEPARTMENT
Chicago
COLUMBIA WATER COMPANY
Columbia, Pennsylvania
BOARD OF WATER COMMISSIONERS
Detroit, Michigan
CITY OF FREDERICK WATER DEPT.
Frederick, Maryland
PUBLIC SERVICE COMMISSION
City of Halifax, N.S., Public Water Supply
WATER BUREAU OF THE METROPOLITAN DISTRICT, Hartford, Connecticut
MUNICIPAL WATER WORKS
Huntsville, Alabama
BUREAU OF WATER
Lancaster, Pennsylvania
CITY OF LYNCHBURG WATER DEPARTMENT, Lynchburg, Virginia
MOBILE WATER WORKS COMPANY
Mobile, Alabama
QUEBEC HYDRO-ELECTRIC COMMISSION
Montreal, Quebec
PUBLIC WORKS DEPT., WATER-WORKS & SEWERAGE DIV., Montreal, Quebec
PENNICHUCK WATER WORKS
Nashua, N. H.
WATERWORKS DEPARTMENT
City of Nashville, Tennessee
DEPT. OF WATER, GAS & ELECTRICITY
New York, New York
DEPT. OF PUBLIC WORKS, BUREAU OF WATER, Philadelphia, Pennsylvania
BUREAU OF WATER, DEPT. OF PUBLIC WORKS, Pittsburgh, Pennsylvania
POTTSVILLE WATER COMPANY
Pottsville, Pennsylvania
BUREAU OF WATER
Reading, Pennsylvania
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DIVISION OF WATER & SEWERS
Sacramento, California
WATER & SEWERAGE DEPARTMENT
City of Saint John, N.B.
DEPT. OF PUBLIC UTILITIES, WATER DIVISION, St. Louis, Missouri
WATER DIVISION, DEPT. OF ENGINEERING, Syracuse, New York
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CITY OF UTICA, BOARD OF WATER SUPPLY, Utica, New York
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WATER DEPARTMENT
City of Winston-Salem, North Carolina
YORK WATER COMPANY
York, Pennsylvania
WATER DEPARTMENT
City of Zanesville, Ohio

TODAY... modernized cast iron pipe, centrifugally cast, is even tougher, stronger, more uniform. *Where needed and specified,* it is centrifugally lined with cement mortar to assure sustained carrying capacity throughout its long years of service.

On its record, CAST IRON PIPE is the world's most dependable carrier of water.

Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director,
122 So. Michigan Avenue, Chicago 3.

CAST Q IRON

The Q-Check stencilled on pipe is the Registered Service Mark of the Cast Iron Pipe Research Association.

pipe FOR MODERN WATER WORKS OPERATION

Grandpa thought he was saving money...

"Yes, dear, 25 years ago grandpa was on the Water Board when they ran the pipe line out Madison Street to Western Heights. Grandpa and the other members voted to buy a substitute for cast iron pipe—they thought they were saving money. Now this pipe has failed entirely after years of expensive maintenance caused by breaks and leaks.

"Tonight we're letting a contract to replace that pipe. As Water Board chairman, I'm going to recommend the purchase of Clow Cast Iron Pipe—a pipe with a *proven* record of long service and low maintenance expense. It might cost a little more now than substitutes do, but it will be much less expensive in the long run. You might say that cast iron pipe is the taxpayer's friend—and Clow centrifugally cast pipe is the most economical of all. What's more, we've talked to other waterworks officials and Clow has a wonderful reputation for consistent high quality and excellent service."

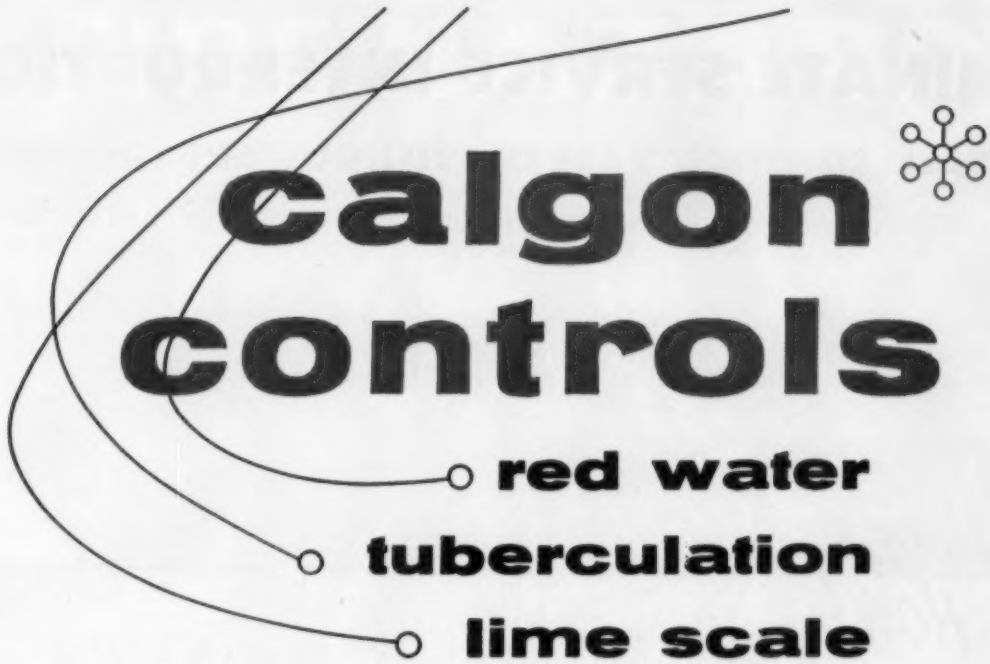
Clow Cast Iron Pipe meets all currently approved specifications now in existence. Write today for factual information and case histories on Clow's 75-year-old reputation for economy.

JAMES B. CLOW & SONS

201-299 N. Talman Ave. • Chicago 80, Illinois

Subsidiaries: Eddy Valve Co., Waterford, N.Y.
Iowa Valve Co., Oskaloosa, Iowa

CAST IRON



simply · effectively · economically

CALGON* stabilizes iron and manganese dissolved in water, prevents iron pickup from pipes, Calgon is easy to use—stops Red Water effectively and *economically.*

Tuberculation in mains can lead to costly cleaning, and leave permanent damage difficult to repair. Corrosion control† with Calgon reduces tuberculation to a minimum, keeps flows high, and lowers pumping costs. Many communities using Calgon have found that power savings alone have exceeded chemical costs.

Calgon stops lime scale by forcing calcium carbonate and other scale forming chemicals to stay in solution, even when the water is heated. Calgon treatment to prevent lime scale is economical since Calgon is used in threshold amounts, and the reduction of lime scale means important savings in keeping equipment and meters clean.

Call on Calgon for the solution to your specific problem. Many years of experience with water problems of all kinds in every part of the country are at your service.

*Calgon is the Registered Trade Mark of Calgon, Inc. for its glassy phosphate (sodium hexametaphosphate) products.

†Fully licensed for use under U. S. Patent 2,337,856 and 2,304,850.

calgon, inc.

A SUBSIDIARY OF HAGAN CORPORATION

HAGAN BUILDING • PITTSBURGH 30, PA.

HAGAN
HALL
BUROMIN
CALGON

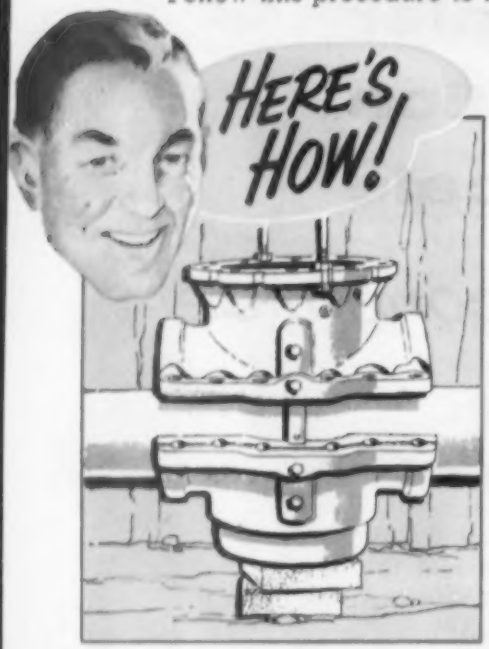
ELIMINATE SERVICE INTERRUPTIONS

INSTALL CONTROL VALVES WITHOUT SHUTDOWN!

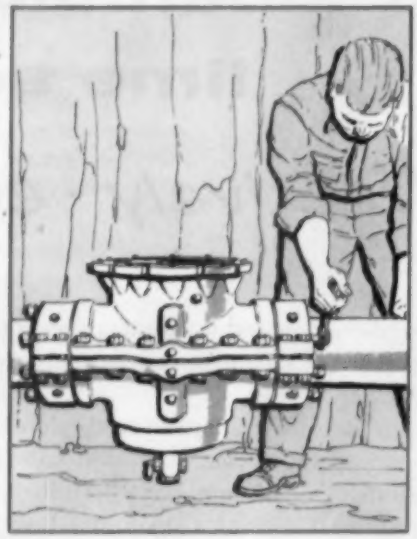
Now you can install control valves without shutting down even a small part of your city's water system. Inconvenience to customers and danger of fire is completely avoided by using Mueller Inserting Valves.

Mueller Inserting Valves may be installed in any existing line under pressure and, once installed, are operated like standard gate valves. In fact, the mechanism of Mueller Inserting Valves is identical to that of Mueller AWWA Gate Valves and repair parts are interchangeable.

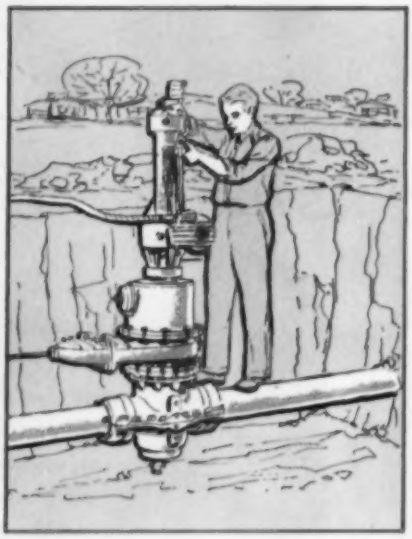
Follow this procedure to install . . .



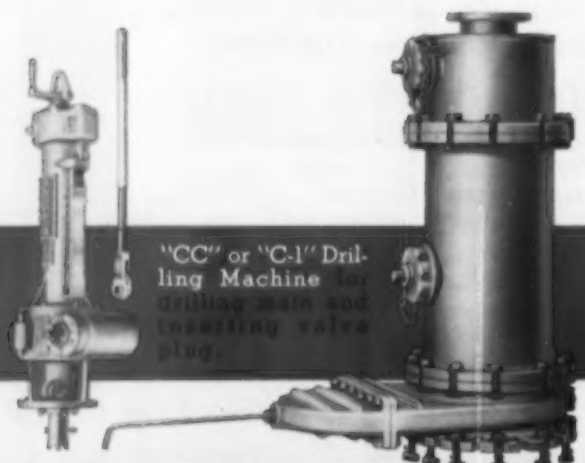
STEP 1. BOLT SLEEVE TO MAIN.
Main is cleaned and sleeve halves are bolted together around main.



STEP 2. PREPARE SLEEVE.
Sleeve is calked and leaded to main in desired position and slide valve is attached.



STEP 3. MAKE CUT.
Section of main inside of sleeve is removed with Mueller "CC" or "C-1" Drilling Machine.

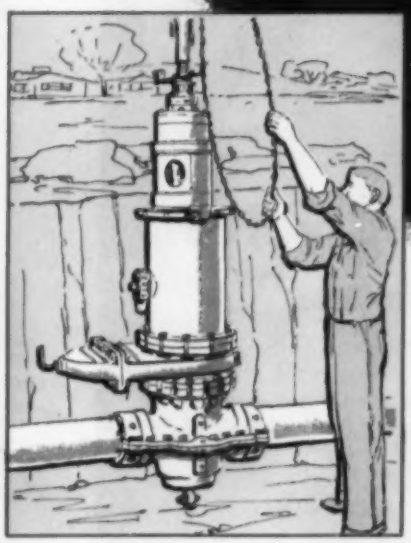


"CC" or "C-1" Drilling Machine for drilling main and inserting valve plug.

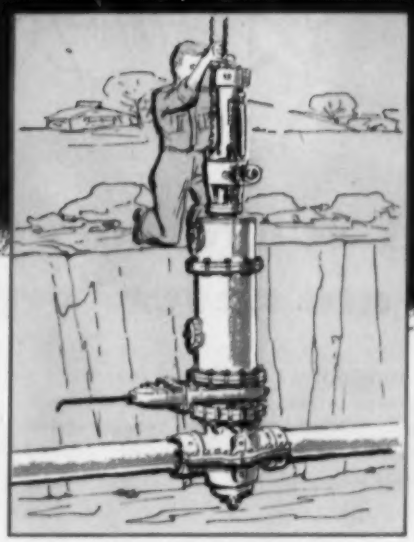
H-810 Basic Inserting Equipment permits insertion under pressure of all sizes of inserting valves.

H-800 Inserting Valve
Sizes 4", 6", 8".
Shipment from stock

AND FIRE HAZARDS!



STEP 4. PREPARE VALVE PLUG.
Long adapter is bolted to slide valve and valve plug is readied for insertion into main.



STEP 5. INSERT VALVE PLUG.
"C-1" machine is fastened to valve plug to lower plug into place under pressure.

STEP 6. COMPLETE INSTALLATION.
Packing screws are tightened and lead is poured into top joint to seal valve plug in place.

Control Valves at vital points permit:

- Installation or repair of fire hydrants
- Isolation of small sections
- Extension of mains
- Modification of system . . . without extensive shutdown

Call your Mueller Representative or write for Catalog H-20 for complete information.

MUELLER CO. DECATUR, ILL.

Dependable since 1857

FACTORIES & OFFICES AT DECATUR CHATTANOOGA LOS ANGELES SARNIA ONTARIO

Proud "city fathers" must look to the future, too!

IOWA hydrants and valves are never "orphans"!

No need to worry about the future of your city's water system when you choose *Iowa.* You know you're buying a reliable product from a reliable firm and that there will always be replacement parts, when and as needed. What you may not know, though, is this . . . *Iowa* hydrants are easily and economically serviced—even by new employees without special training.

Below are additional facts to keep in mind when you plan to expand or replace any part of your city water works.

IOWA HYDRANTS

Provide full, truly unrestricted water way.

Open *with* the pressure for faster water delivery.

Close *against* the pressure to eliminate water hammer, provide flushing action.

Assure positive drainage.

Are available for any type of connection.

All working parts removable through top—no digging or special tools required.

Meet all A.W.W.A. specifications.

IOWA GATE VALVES

Double disc, parallel seat.

Positive wedging action for efficient, no-leak closing.

Gates hung loosely from stem nut—no binding.

Rugged, time-proved design means long life, low service costs.

Available with bell, flange, or mechanical joint connections to fit any existing or planned installation.

Meet all A.W.W.A. specifications.

The best insurance policy is the order that specifies IOWA!

IOWA VALVE COMPANY
A Subsidiary of James B. Clow & Sons
201-299 NORTH TALMAN AVENUE
CHICAGO 80, ILLINOIS

Palate-inviting water
may not have the same aroma and
effects as wine, but it is still a delight to drink.
People appreciate and are demanding fine tasting and delicious water. As a means of giving water proper treatment to minimize complaints, water plant operators have come to rely upon AQUA NUCHAR activated carbon. It offers effective and economical means of crossing the threshold into palatable and sparkling water.

Without any obligation Industrial Chemical Sales will send their Threshold Odor Specialists to give your plant a complete taste and odor survey. They will explain to your chemist the procedures of the Threshold Odor Test and advise how to use AQUA NUCHAR activated carbon with other water-treatment chemicals. In addition, they will also aid in determining AQUA NUCHAR'S most economical and effective point of application. To take advantage of this service call your nearest Industrial office.

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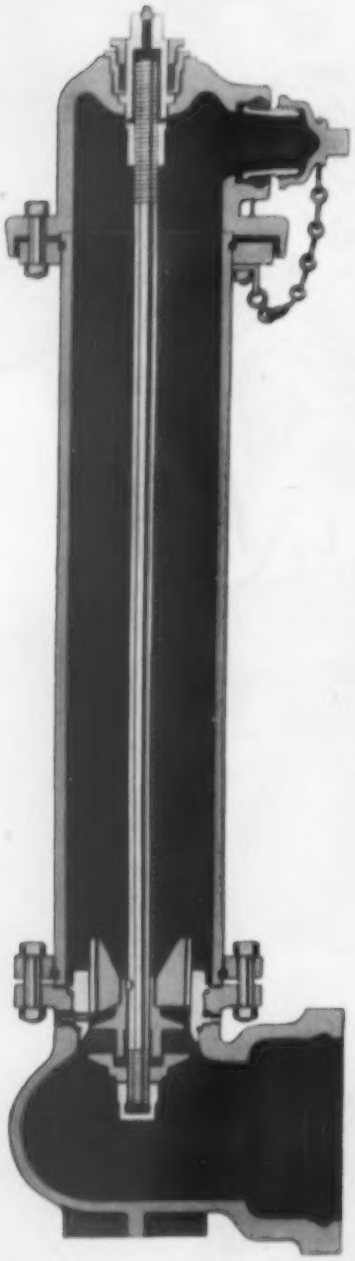
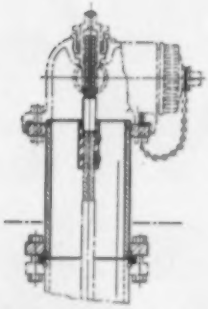
Cleveland 20, Ohio

COSTS LESS TO INSTALL
COSTS LITTLE TO MAINTAIN



A community can rest easy when it is protected by R. D. Wood Swivel-Joint Hydrants. Trouble can be a long time coming, but when it comes these great hydrants are ready. Installation and maintenance costs are low. They work instantly, reliably. Water-carrying areas are generously sized for full flow and maximum pressure. Every point of friction is protected by at least one bronze surface. Accurately formed threads and fitted parts make them interchangeable with other hydrants of the same size. Compression-type valve stops leakage when hydrant is broken in traffic accident.



Extension piece can be inserted between hydrant head and barrel, or between barrel and elbow, without shutting off water supply.

Breakable flange and stem coupling can be furnished at extra cost. Both are constructed so that a heavy blow will snap the ring and coupling, thus saving more costly damage to the hydrant itself. Both can be replaced quickly and inexpensively with spares. No digging necessary.

R.D.Wood Swivel Joint Hydrants

Public Ledger Building, Philadelphia 5, Pa.
Manufacturers of "Sand-Spun" Pipe
(centrifugally cast in sand molds) and R. D. Wood Gate Valves

Send for this 80-page catalog. It contains full information about the R. D. Wood line of Cast Iron Pipe, Fire Hydrants, Gate Valves, and Hydraulic Machinery.

FAMOUS LIGHTHOUSES OF AMERICA

Portland Head Lighthouse, Maine, was built between 1787 and 1790 by two Portland masons engaged by George Washington, who instructed them to use rubblestone taken from fields and shores. During the Civil War, when raids on shipping required sighting the light from greater distances, the tower was raised 8 feet. Today it stands 80 feet above land and 101 feet above water at the southern entrance to Portland Harbor. It is one of the four Colonial lighthouses that have never been rebuilt.

A Landmark of Quality in the field of electrochemicals is the name Niagara Alkali Company. First to produce several of these important chemicals in America, Niagara is a pioneer in their development and application. You can rely on Nialk® Liquid Chlorine, Nialk Caustic Potash, Nialk Carbonate of Potash, Nialk Paradichlorobenzene, Nialk Caustic Soda, Nialk TRICHLORethylene, Niagathal® (Tetrachloro Phthalic Anhydride).

NIAGARA ALKALI COMPANY

60 East 42nd Street

New York 17, N. Y.

MECHANICAL JOINTS

...another plus feature available with

VALVES AND HYDRANTS

DARLING mechanical joint valves and hydrants are built to approved standards and provide all the recognized advantages—such as simple, fast installation with no special skills required . . . and assurance of tight joints.

But whether or not you require mechanical joints, don't forget the outstanding *performance* advantages that only Darling Valves and Hydrants can give you. For example, there's Darling's revolutionary B-50-B packless dry-top hydrant development with its ball-bearing operation and "O" ring seals. And in gate valves, Darling's fully revolving double disc, parallel seat principle . . . for long life, low maintenance and unmatched operating ease.

Be sure to get *all* the facts. Complete information is yours for the asking.

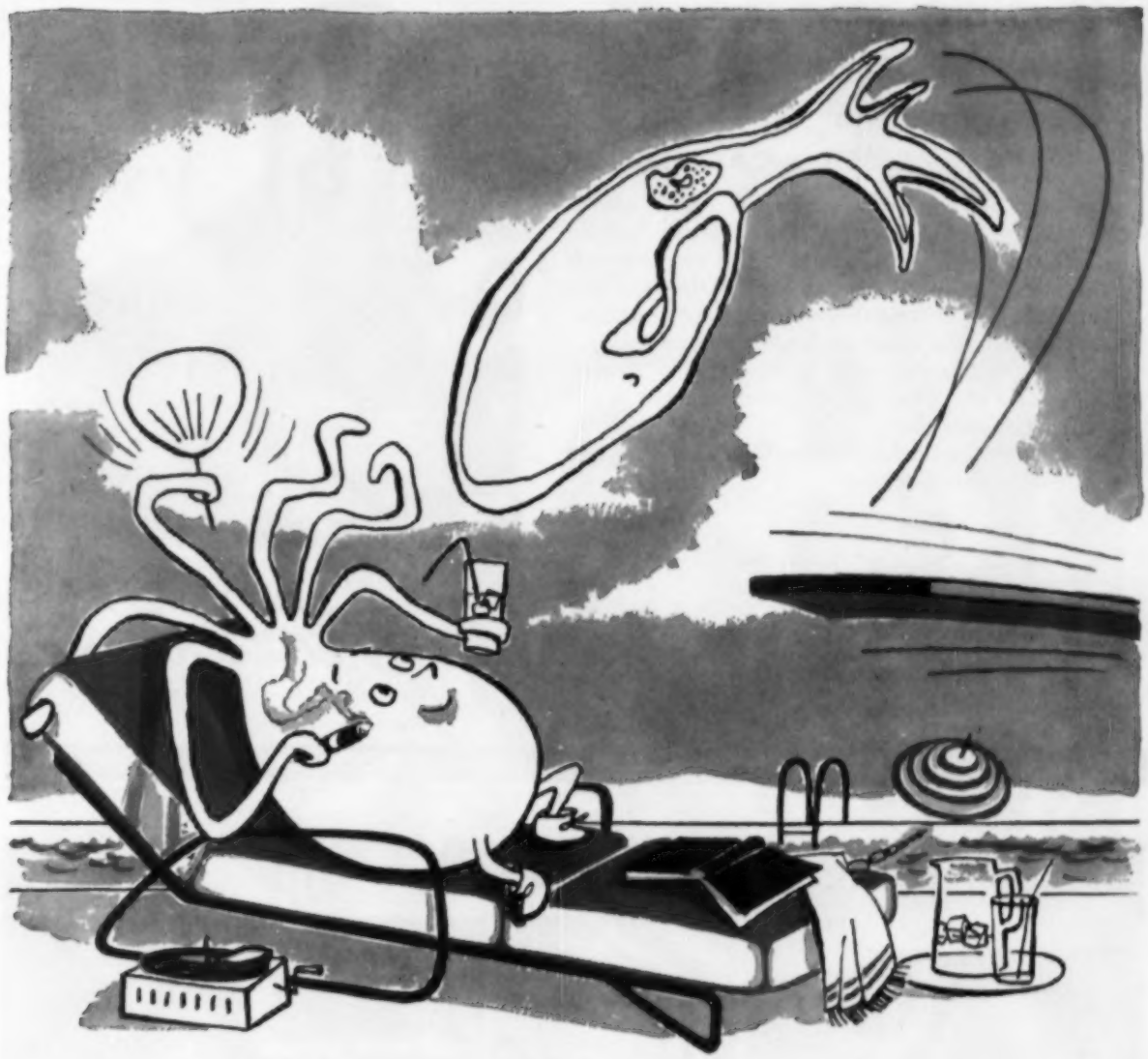
Darling B-50-B Fire Hydrant with mechanical joint.

Darling Revolving Disc Gate Valve with mechanical joints.

DARLING VALVE & MANUFACTURING CO.

Williamsport 11, Pa.

Manufactured in Canada by The Canada Valve & Hydrant Co., Ltd., Brantford 7, Ont.



"Enjoy each day as it comes, Orgie, Tomorrow they may use PITTCHLOR® *"*

That's mighty good advice. Live it up! Because once Pittchlor is put on the job it means fast, certain death to chlorine-susceptible bacteria and algae.

A stable, high-test calcium hypochlorite containing a minimum of 70% available chlorine, Pittchlor works fast and effectively in chlorinating water supplies, treating sewage, or wherever the germicidal and deodorizing action of chlorine is needed.

Pittchlor is dry, white and free-flowing. Its granular form permits ease of application either manually or by mechanical feeders. Write for free folder.

For water purification, sewage treatment, swimming pool sanitation

Stocked by leading jobbers in 5 lb. resealable cans (9 per case), 3¼ lb. cans (12 per case) and 100 lb. and 130 lb. drums.

COLUMBIA-SOUTHERN CHEMICAL CORPORATION
SUBSIDIARY OF PITTSBURGH PLATE GLASS COMPANY
ONE GATEWAY CENTER · PITTSBURGH 22 · PENNSYLVANIA

DISTRICT OFFICES: Cincinnati • Charlotte
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IN CANADA: Standard Chemical Limited and its Commercial Chemicals Division

If SAND is your city's SEWER PROBLEM take a tip from FRESNO, CALIFORNIA

This sand pile is part of 15 cubic yards recently removed from a 438 foot section of 24" line in Fresno.

"Flexible" 25 h.p. Bucket Machines were chosen by Fresno as most of the pipes to be cleaned were of large diameter and because they will pull the largest fully-loaded buckets at speeds up to 125 feet per minute.

With 10 different models to choose from, "Flexible" provides a complete range of Bucket Machines to meet all budget problems.

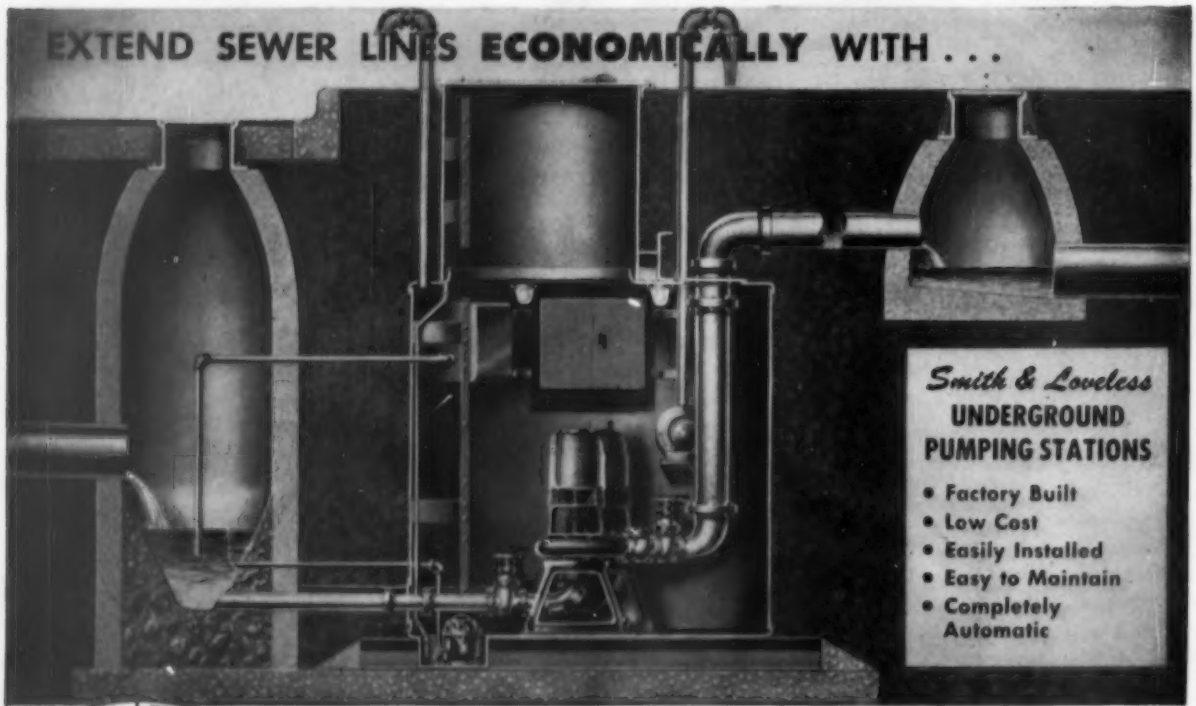
Send for the Bucket Machine Catalog and the name of your nearest distributor.

FREE
DEMONSTRATION INVITED

Flexible INC.
3786 DURANGO AVE., LOS ANGELES 34, CALIF.
(Distributors in Principal Cities)

AMERICA'S LARGEST LINE OF PIPE CLEANING TOOLS AND EQUIPMENT

EXTEND SEWER LINES ECONOMICALLY WITH . . .



Smith & Loveless
UNDERGROUND PUMPING STATIONS

- Factory Built
- Low Cost
- Easily Installed
- Easy to Maintain
- Completely Automatic

S&L *Smith & Loveless, Inc.*

Write for your free copy of our Engineering Data Manual, containing full details on Smith & Loveless Pumping stations.

P. O. BOX 8172, KANSAS CITY, MO., Plant, MERRIAM, KANSAS

THE SUN'S HEAT AND GIANT REFLECTORS may convert cosmic energy into power that will propel space ships to distant planets.

100 years from now...

WE MAY "SIGHT SEE" ON MARS

A century from now, when undreamed-of marvels transform our way of life, civilization will still rely on one familiar public servant: the cast iron pipe laid today will continue to carry water and gas to the homes of the future.

Proof? 69 American cities and towns are still using cast iron water and gas mains over a century old. And today's modernized cast iron pipe . . . centrifugally cast and quality controlled . . . is even stronger, tougher, more serviceable.

U.S. Pipe is proud to be one of the leaders in a forward-looking industry whose service to the world is measured in centuries.

U.S.
cast iron
PIPE
FOR WATER, GAS, SEWERAGE AND INDUSTRIAL SERVICE
CAST IRON

U. S. PIPE AND FOUNDRY COMPANY, General Office: Birmingham, Alabama

A WHOLLY INTEGRATED PRODUCER FROM MINES AND BLAST FURNACES TO FINISHED PIPE.

ElectroniK recorder centralizes supervision of digester temperatures

In about twenty-eight years, the sewage treatment plant at Sioux Falls, South Dakota, has more than doubled in capacity. A continuing modernization program, making full use of instrumentation, has enabled the plant to keep pace with increased demand, and at the same time to improve efficiency and reduce operating costs.

Typical of the up-to-date techniques at work in this plant is the instrumentation for the supervision of digester temperatures. A multi-point *ElectroniK* recorder, located in the superintendent's office, concentrates data on temperatures of incoming wastes, outside atmosphere, effluent, heating water and sludge. At the turn of a dial, the superintendent can switch to any of the four digesters to check its condition . . . without moving from his office.

Other Brown instruments throughout the plant aid in control of flow equalization to maintain constant throughput . . . in dewatering of sludge . . . in regulating fuel gas pressures for air compressors.

For your own water or sewage treatment processes, you'll find Brown instrumentation that matches every requirement you have for measurement and control of critical variables. Your local Honeywell sales engineer will be glad to discuss your specific project with you and your consulting engineer . . . and he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.

● REFERENCE DATA: Write for Data Sheet No. 9.6-4a, "Instrumentation of Sludge Digesters"... and for Catalog 1521, "ElectroniK Recorders."

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS

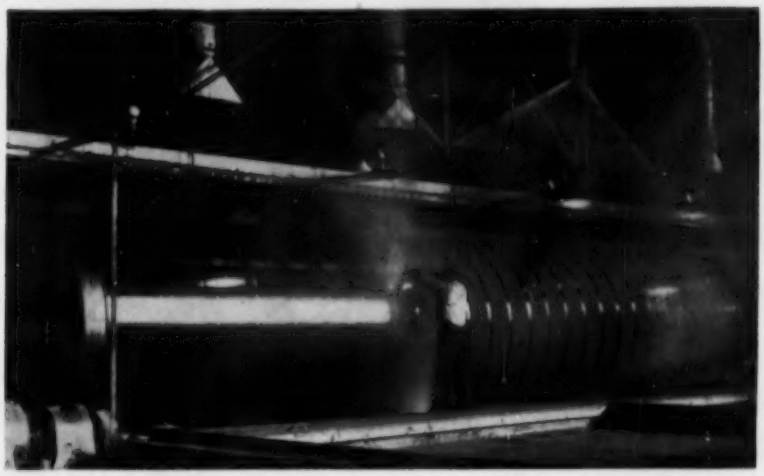
First in Controls

96-In. ID Pipe--From Shop to Site

ACCURATE BEVELING of the plate edges ensures tight longitudinal welds.

POWERFUL 40-FT ROLLS are shown here curving 9/16-in.-thick plates into one-third cylinders. After tack-welding the plates are ready for final welding.

THE PIPE IS WELDED from inside and out by the submerged-arc process.



NEWLY ENLARGED FACILITIES at Steelton permit the fabrication, grit-blasting, lining, coating and wrapping of unusually large-diameter pipe — up to 96 in. ID.

COMPARE THE SIZE of the pipe with the truck and driver. Each length is 40 ft.

BEING INSTALLED near Baltimore where it will serve as an industrial water main, this 23,800-ft line required 597 lengths totalling approx. 7,800 tons.

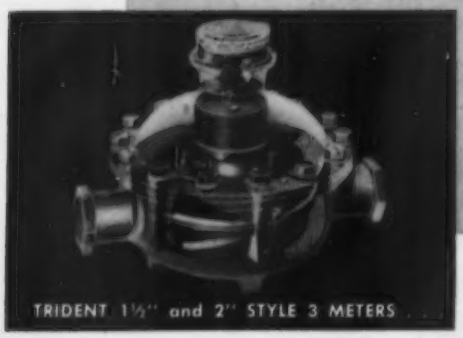
When planning your next water or sewage line, we suggest that you consider the many advantages of Bethlehem Tar-Enameled Steel Pipe. For further information, please contact the Bethlehem sales office nearest you.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL



LARGE METER *Capacity* + SMALL METER *Sensitivity* = MAXIMUM *Revenue*

No proud father would argue that twins are as easy to take care of as one. That's one reason Neptune Trident Style 3 meters are recommended in place of compound meters for 1½" and 2" service lines. The Style 3 disc meter is accurate down to exceptionally low flows, and handles high flows with ease.

The simpler Style 3 meter maintains accuracy longer, and repairs (when necessary) are easier. Modern Style 3 parts fit older meters. There's no obsolescence . . . you modernize as you go. And its lower initial cost gives you a nice saving. So why use two meters when one will do the job?

Style 3 meters were the first to feature a special pressure adjustment. In high-pressure lines, the outlet of the meter is throttled to prevent overspeeding, and in low pressure installations, the outlet is opened wide to minimize loss of head.

Proof of the accuracy and efficiency of the Trident Style 3 will be found in your own testing equipment . . . in lower maintenance costs . . . and in increased revenue.

NEPTUNE METER COMPANY
19 West 50th Street • New York 20, N. Y.

NEPTUNE METERS, LTD.
1430 Lakeshore Road • Toronto 14, Ontario

Branch Offices in Principal American and Canadian Cities

neptune

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WATER & SEWAGE WORKS

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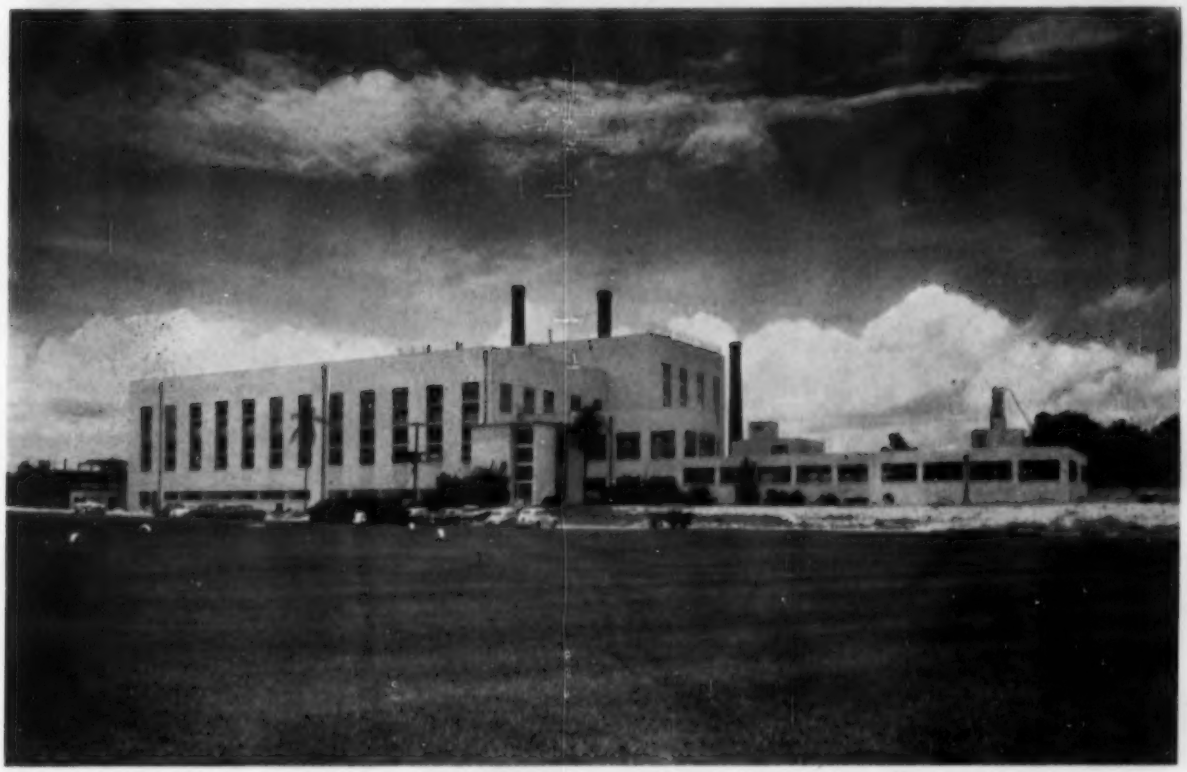


COMBINED power and water plants make compact Orlando utilities unit

Orlando Water Plant Modernization

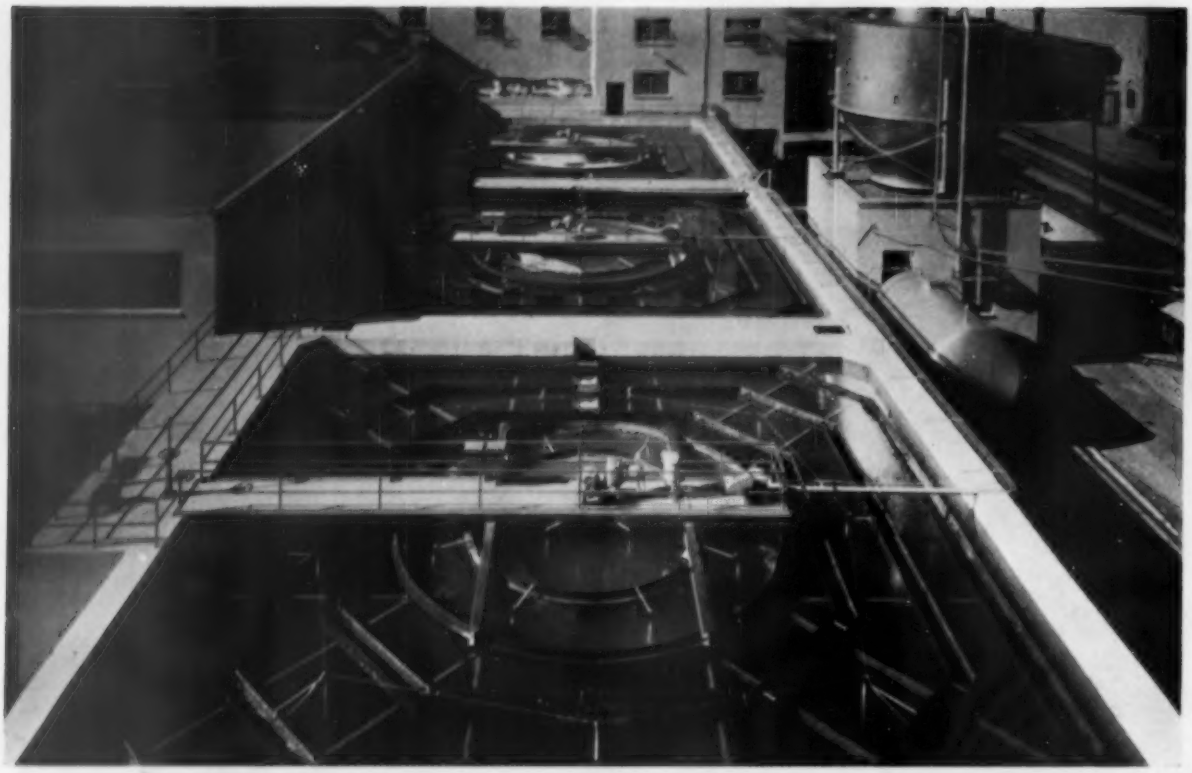
Program of Florida city keeps pace with community needs

by C. H. STANTON

Mr. Stanton is General Manager of the municipally owned and operated Orlando, Fla., Utilities Commission. His paper shows that the problems facing water facilities because of rapid municipal growth can be solved when they are recognized and acted upon soon enough.

ORLANDO, the metropolis of the famous central Florida lake region, is also famous as a center of citrus fruit packing and citrus frozen concentrate production from which the best known Florida oranges and the most popular brands of concentrate are shipped.

It is not surprising, therefore, that after World War II great numbers of people, attracted by highly promising commercial opportunity and the prospect of a fine home in a lovely community, settled in Orlando. The water and light utilities soon showed the strain of this great influx of population, and plans were quickly underway to substantially increase their capacity. A completely new municipal water purification plant and electric generating plant was planned at a site near the existing plant. As it developed, the new plants came none too soon, because long before they were



SUCCESSIVE ADDITIONS of 8-mgd flocculator-clarifier units have tripled original plant capacity

placed in operation, the old plants were seriously overloaded.

Original Water Treatment Plant

Orlando's water supply is taken from a series of connected shallow lakes. Clarification and filtration are required, in addition to chlorine disinfection, because of algae and organic matter in the lake water. The original water treatment plant provided alum flocculation for a short time, after which the process was standardized to include aeration, breakpoint chlorination, lime stabilization in settling basin, and post-chlorination.

This type of operation was necessitated by inability to use the flocculation and coagulation units because practically all of the floc, instead of settling, floated and formed an evil smelling mat on the surface of the sedimentation basin; the taste that this floating sludge mat imparted to the water eventually forced discontinuance of the alum flocculation and coagulation. The water, thus partially treated, although safe, grew slimes in the distribution system. The water supply developed an "earthy" taste from these slime growths.

New Water Treatment Plant

Construction on the new plant was started early in 1948 in conjunction with construction of the ultra-modern electric generating plant. The water treatment plant was ready to operate in July 1949. Capacity of the new plant was originally planned at 8 mgd, with plans for an additional 8 mgd. The combined capacity of the old and new plants at that time was 16 mgd. The plans also provided for aerators (or better, de-gassifiers) for carbon dioxide release from the raw water, two 8-mgd modern combined flocculating and upflow settling basins, and additional new rapid sand filters plus chlorination.

TABLE 1

Coagulant Dosage

Chemical	Dosage		
	Max.	Min.	Ave.
Alum, grains per gal.	2.5	2.5	2.5
Act. silica, ppm	3	2.5	2.75
Lime, ppm	14	10	12
Clay, ppm	0	0	0

Remembering all of the trouble experienced with floating floc mats in the old sedimentation basin, it was felt of the utmost importance that the upflow treatment basins be not only efficient but also versatile in order to cope with the difficult treatment problem presented by the algae and organic material present in the raw water. Certainly no one wanted to have a repeat of the old standard clarification basins. After visiting and studying several makes of upflow treatment basins in several parts of the country, where water was being treated for algae and color removal, the Walker Clariflow unit was selected. The units of this type that were visited not only were giving good results, but also appeared to have the flexibility required for a difficult raw water like that at Orlando. Experience has proved that this was a wise choice.

The Upflow Basin

The Clariflow unit is a simple, rugged, and well-designed upflow basin. Raw water and the coagulant

chemical enter the center mixing and reaction basin. A variable-speed multi-stage propeller mixer circulates the contents of this basin, bringing the raw water and admixed coagulants into intimate contact without undue turbulence.

The intimately mixed contents of this center basin displace through adjustable diffusion gates near the water surface into a secondary floc-building chamber which is concentric with the center basin. The multiple diffusion gates are set to cause a velocity of flow through them of 1 to 3 f.p.s. This results in a pronounced, uniform rolling motion in the floc-building chamber which varies only slightly with inflow variations. Observing the surface of this chamber, it appears as though a mechanical flocculation unit were in operation beneath the surface. This uniform rolling motion, in addition to providing excellent particle contact for floc growth, provides a balanced energy distribution that prevents training of influent vectors and stray currents which cause floc "blow-ups."

At the bottom of the flocculation chamber is a horizontal baffle with openings uniformly distributed. The velocity through these openings is much less than that through the multiple diffusion gates. However, it is sufficient to permit the mixed floc and water, which act as a fluid having a specific gravity greater than water, to distribute uniformly as a balanced density current underflowing the clear water in the sedimentation basin proper. The floc particles, as they are distributed in this manner over the bottom of the sedimentation basin, subside into a cohesive mass or "sludge blanket."

A mechanical scraper continuously squeegees the settled sludge to a draw-off sump, from which it is automatically blown off. This mechanical scraper not only eliminates shoals and an undesirable build-up of the sludge blanket, but it also reduces the blow-down volume to less than 1 per cent of the total treated volume. It also completely eliminates the need for emptying the tanks periodically to shovel out and hose down sludge banks and excessive sludge accumulations.

The clarified water, freed of the floc particles, displaces uniformly upward toward a weir trough system consisting of three concentric troughs which draw off the clarified water at the surface. The weir troughs, in turn, discharge through a drop box into the filter bed flume.

AERATORS (foreground) remove dissolved carbon dioxide prior to clarification

TON CONTAINERS in lighted outside storage serve post-chlorination units

Clariflow Operation

The operating results of the Clariflow are much better than those obtained in the years of struggle with the old basin and its floating floc. Filter runs are now around 100 hours, and less than 2 per cent of the water treated is used for filter washing. The Clariflow units have even been operated at 12 mgd each (150 per cent of rating) and at this rate the turbidity averages only 0.8 ppm. The manufacturer's performance guarantee called for not over 10 ppm.

The versatility of the Clariflow unit has a lot to do with the excellent results obtained. At first a tendency was noted for the floc to try to float. At that time alum was being introduced prior to aeration and silica immediately after aeration. A change was made to feed the alum and silica through a common manifold into a flume directly beneath the aerators, which consist of four rotary distributors sprinkling the raw water over an 18-in. bed of rocks, breaking the water into myriads of thin films from

TABLE 2

Summary of Operation, 1953 Averages

Month	Daily Volume, MGD	Raw Water Turbidity	Clarifier Effluent Turbidity	Length of Filter Runs, Hours	Chemical Cost per MG Treated
January	9.38	1.4	1	128	$14.64
February	9.19	1.3	1	130	15.08
March	11.62	1.9	1	165	14.92
April	11.07	2.4	1	156	15.70
May	16.11	1.7	1	243	15.58
June	12.00	2.1	1	151	16.40
July	13.03	1.5	1	163	16.85
August	9.73	2.4	1	122	17.50
September	9.13	1.5	1	117	17.14
October	9.22	1.7	1	119	15.97
November	10.04	2.1	1	132	15.85
December	9.54	1.7	1	121	15.17

which the dissolved carbon dioxide in the water is released.

The alum starts to form a floc here, but this is broken up in the center mixing basin, releasing the molecular oxygen formed by algae photosynthesis from the dissolved carbon dioxide. During the first periods of operation clay was added to help settle out the floc, but this practice has since been discontinued. The Clariflow is particularly adaptable to this method of treatment because of the way the mixing tank is constructed and because the flocculating basin around the mixing tank permits reforming of the floc broken up by this method of operation.

Current Plant Addition

After a little more than a year of operation, it became apparent that the 16-mgd plant capacity would soon be inadequate. Orlando kept right on growing at a phenomenal rate and, because the quality of the water was so much better, more was being used per capita.

It was decided to add another 8-mgd unit to the new plant. In February 1952 contracts were let and construction has now been completed. The upflow basin of the new addition is another Clariflow unit.

The new unit, as well as the existing units, is designed to permit operation for lime softening as well as for algae and color removal.

Summary

The Clariflow units at Orlando have performed even better than expected in treating an unusually difficult water for algae and color removal. Their fine performance is attributed to their versatility, which enables them to adapt to varying treatment requirements, and to their hydraulic design with its balanced energy distribution, by which they accomplish an excellent degree of treatment with less than an hour's retention.

W&SW

Commerce Dept. Conference With Water and Sewerage Industry

Adoption of a uniform, nationwide policy with respect to financing relocation of water and sewerage facilities made necessary by new construction of highways was suggested by representatives of the water and sewerage industry and utilities at a recent conference with the Business and Defense Services Administration, U. S. Department of Commerce, and officials of other Government agencies.

Industry spokesmen pointed out that there are only 22 States which have Federal participation in financing such projects, and that in many cases the burden of this cost falls upon local taxpayers who receive no benefit from relocation of a water or sewerage line. It was urged by the industry this situation be given immediate attention by appropriate Government authorities with a view to correcting any "inequities," as a part of the study now under way.

Some concern was expressed by water works officials and others over the inadequacy of water supply and facilities in many areas of the country. Industry speakers indicated they are apprehensive about the Nation's water supply which, they said, would not be sufficient to meet requirements in case of all-out mobilization. A margin of water supply over requirements which existed in 1942 has now disappeared, they declared.

The growing requirements of industrial plants for water and the absence of historical statistics on such needs was another subject discussed at the conference. Maxwell R. Conklin, Chief of the Industry Division, Bureau of Census, told the conferees that a survey was made of manufacturing industrial water use in connection with the 1953 Survey of Manufacturers, the results of which will be made known in August.

Attending the conference were thirty representatives of water works, sewage works, consulting engineers, manufacturers, well drillers and equipment suppliers, and consultants.

Case Institute Research on Industrial Waste Disposal

Case Institute of Technology is making its research facilities and talent available to the community by undertaking a research program on industrial waste disposal in the Cleveland area. Local companies supporting and participating in this program to date are: the American Steel and Wire Division of the United States Steel Corp., The Cleveland Electric Illuminating Co., Harshaw Chemical Co., Industrial Rayon Corp., Jones & Laughlin Steel Corp., Republic Steel Corp., and the Sherwin-Williams Co. The program has been endorsed by the Committee on Industrial Wastes of the Cleveland Chamber of Commerce and the Ohio Department of Health.

Directing this carefully planned study will be Professor George E. Barnes, head of Case's Civil Engineering and Engineering Mechanics Department. Working with Professor Barnes will be Leon W. Weinberger, Assistant Professor.

Well Rehabilitation by Chlorination

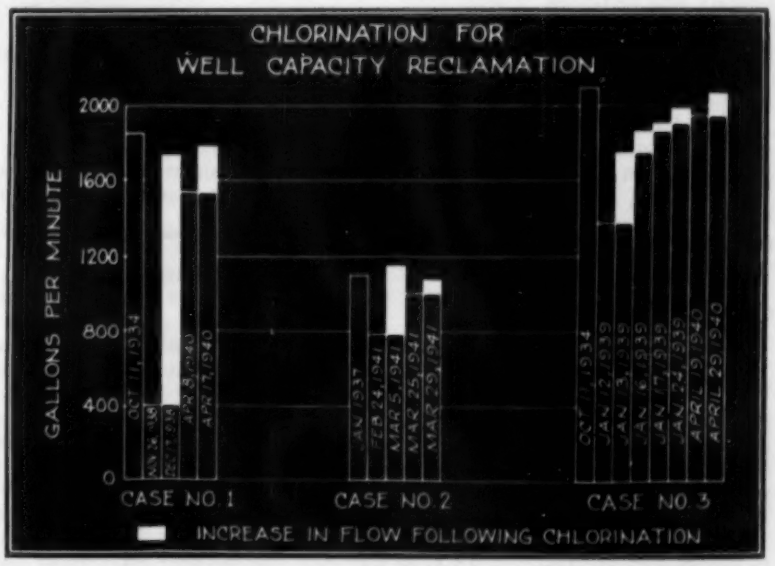
A Case Study of Chlorine Applications Used Specifically To Eliminate Clogging Growths of Iron Bacteria

by A. E. GRIFFIN

Mr. Griffin is Director, Technical Service Division, Wallace & Tiernan Co., Inc., Newark, N. J. He reviews experiences in the effective use of chlorine to increase well capacity. His paper was originally presented at a meeting of the New Jersey Section, AWWA, and is here published with permission.

CHLORINE treatment to increase the yield of wells, sometimes called well rejuvenation, seems to be standard practice in that broad area of the United States lying between Lakes Michigan and Superior southward to the Gulf of Mexico. That the method is so widely used in this area is because iron bacteria, the bacteria which clog well screens so effectively, and which yield to chlorine treatment so easily, are especially abundant in the underground water throughout this territory. In fact, the area immediately adjacent to Green Bay, Wisconsin has earned the reputation of harboring the most lush growth of iron bacteria of any place in the United States and perhaps of any place in the world.

Chlorine treatment was born of necessity and has prospered by its practicality. The treatment is specialized and is effective when used specifically for the elimination of the bacterial growths that clog well strainers, the areas immediately adjacent to the strainers, the pump bowls and the piping leading to the surface. Where well capacities have declined considerably because of these growths, and where there has been a negligible change in the ground water level, chlorine treatment has increased capacities sometimes to their original figure.



THREE CASE HISTORIES—The effect of chlorination on reclamation of well capacity.

Selecting the Point of Application

For such treatment the point of application should preferably be at the bottom of the well. When applied at this point, the chlorine comes in immediate contact with the sand and gravel surrounding the screen, the screen, the pump, and by diffusion with the piping above the pump. The usual routine is to apply the chlorine and then allow the well to "soak" from 12 to 24 hours—assisted, perhaps, with occasional "bumping" or "surging" to make sure that the chlorine is carried up into the pump bowls and the piping carrying the water to the surface. This practice also tends to force the chlorinated water into the sand and gravel surrounding the screen. Of course, the well must be flushed before replacing in service.

Where it is impossible or impractical to apply the chlorine at the bottom of the well it may be applied to the pump discharge. When applied at this point the main discharge line should be closed and a by-pass of smaller diameter should be installed. Chlorine is applied to this by-pass water with which the well is back-flushed after the well has "soaked" in heavily chlorinated water, containing 50 ppm to 100 ppm residual chlorine.

Rate of Chlorine Feed Required

The rate of chlorine feed depends, of course, on the rate of water feed used in back-flushing, and the amount of chlorine used depends upon the quantity of water needed to displace the water in the suction pipe and in the area immediately adjacent to the screens. Care must be taken to prevent overdosing with chlorine to the point where the pH value of the water will be reduced below 4.0. If the pH is allowed to drop much below 4.0 the screens may be damaged due to the action of hydrochloric acid.

Should the decrease in yield be due to the presence of excessive amounts of dissolved salts, or to iron hydroxide or carbonate, other cleaning methods than chlorination should be used. Furthermore, chlorine treatment should not be used where the drawdown is so great as to allow the entrance of air. In such instances, the use of chlorine may "worsen" instead diminish the difficulty. The severity of the problem determines the frequency of treatment.

Case Histories of Well Cleaning

In certain instances where "biofouling" has reached undue proportions, repeated flushing with chlorine may be required at the start, as indicated by Case No. 3, Fig. 1. However,

once the original clean-up has been accomplished, subsequent treatments usually are mild in character. Where pumping is intermittent, and the chlorine is applied in the well, excellent control can be obtained by so arranging the chlorinator equipment that a measured amount of chlorine will flow back into the well between pumpings. Where pumping is continuous, it usually is necessary to back-flush on a regular schedule.

In Fig. 1 are presented operating data on three typical wells whose capacities had dropped to the danger point. In Case No. 1 accumulations around the screen and in the sand had reached such proportions within four years that the well was almost useless. Following alternate treatment with chlorine and proper flushing, the well capacity was increased to 1740 gpm. On April 8th, its capacity was down to 1540 gpm., which was quickly brought up to 1780 gpm. by chlorine treatment on April 19th, 1940. These figures indicate that the growth of the mineral bacteria in this case was relatively slow, but could be eliminated quickly and at slight cost.

Case No. 2, Fig. 1, is somewhat different. This is a well of relatively low yield, falling off in capacity by about 30 per cent over a four-year period. Chlorination brought it back to a yield above the original. However, within a three week period its capacity was again on the downgrade, a circumstance which was remedied by chlorination. It is evident from these data that this well should receive very frequent applications of chlorine.

Case No. 3, Fig. 1, is quite similar to Case No. 1, wherein a large drop in well capacity was noted during the first few years of service. Due either to timidity in chlorination or to especially resistant organisms, repeated surgings with chlorine were required before the desired capacity was restored. Once this capacity was obtained, however, the loss was very slight during the following year; mild chlorination again restored its yield almost to that obtained when the well was first placed in service.

Organisms Involved in Well Fouling

Insofar as can be determined, the bacteriological accumulations on the well screens and surrounding strata are similar in character to the "biofouling" material found in the water distribution system.

The organisms responsible for these organic deposits belong to a group not ordinarily isolated in a sanitary water analysis. This is due to the facts that many of them will not grow on the ordinary culture media employed; that some of them are very difficult to cultivate on any media; and that they seldom are dispersed in the water in appreciable concentrations. Thus, unless their numbers grow to the point where difficulties of one sort or another arise, or unless the coating on the interior of the mains, standpipes, etc., is carefully examined, their presence may go undetected for years.

These water slimes, or organic deposits, usually consist of mucilaginous mixtures of capsulated bacteria, various forms of iron, aluminum, and manganese bacteria, together with higher forms of micro-organisms which may abound in the water itself.

W&SW

J. M. Brown to be Sup't Of New Rochelle Sewage Plant

The Westchester County Department of Public Works recently announced the appointment of James M. Brown, Jr. to the position of Superintendent of the New Rochelle Sanitary District sewage treatment plant.

Mr. Brown will supervise the start-up and operation of the new County sewage treatment plant located at New Rochelle and will assist the Department in other duties relative to sanitary engineering. Before his Westchester County appointment Mr. Brown had been Sanitary Engineer with the Lederle Laboratories Division, American Cyanamid Company, Pearl River, N. Y.

Prof. H. E. Babbitt Retires From Univ. of Illinois

Harold E. Babbitt has retired from his post as Professor of Sanitary Engineering at the University of Illinois.

Professor Babbitt was born in New Jersey and came to the University of Illinois forty-one years ago with a bachelor degree in engineering from Massachusetts Institute of Technology and three years of experience in sanitary engineering with the Chicago Sanitary District and the Ohio State Department of Health. Professor Babbitt's name has become synonymous with sanitary engineering, not only at the University of Illinois but throughout the Middle West.

His honors and his accomplishments as a teacher, researcher, and writer are well known. The fact that he was the founder of one of the nation's first sanitary engineering laboratories at a university is of special significance to Illinois sewage works operators who have benefited so greatly from this single accomplishment of Professor Babbitt.

Professor and Mrs. Babbitt plan to spend a year or two in Seattle where he expects to complete some writing, including the fifth edition of his textbook "Water Supply Engineering."

Paul Kuhn Voted First Harry E. Jordan Scholarship

PAUL A. KUHN, a young and promising sanitary engineer in the employ of the Pacific Flush Tank Company of Chicago, has been chosen to receive the first award of the recently established Harry E. Jordan Scholarship.

This scholarship was established by the Water and Sewage Works Manufacturers Association in recognition of the unusual and meritorious services rendered the American Water Works Association by Harry Jordan during the past 18 years as its Executive Secretary, and prior thereto, as president of the Association. The scholarship, established to further the graduate studies of a deserving young man, expecting to enter or continue in the field of water supply and sewage disposal. The annual award carries an honorarium of $1500 derived from a Trust Fund established by the Water and Sewage Works Manufacturers Association.

Mr. Kuhn received a B.S. degree in Sanitary Engineering from the Univ. of Illinois in 1954 and has continued his studies in evening courses offered by Northwestern Technological Institute while holding a full-time position in the Waukegan, Ill., water department and more recently with the Pacific Flush Tank Co. of Chicago.

The scholarship was formally presented to Mr. Kuhn at the Chicago convention of A.W.W.A. on June 13th. The awardee will continue his studies at Northwestern Tech. on a full-time basis, looking to earning a Master of Science degree a year hence.

Water Service and What It Costs

A Completely Adequate Distribution System

by N. T. VEATCH

Mr. Veatch is a partner of the Consulting Engineering firm of Black & Veatch, of Kansas City, Mo. In this paper he discusses the major problems involved in planning, financing, constructing, and operating a water distribution system.

THE DISTRIBUTION system is the marketing facility of the water utility. It represents some two-thirds of the investment in water works plant of the average community. To provide fully adequate and satisfactory service to the customer requires that the mains making up the system be large enough to deliver water to all users in quantities sufficient to meet their requirements and at adequate pressures.

Water Usage

The customer rate of water use varies over a wide range from city to city. Results of a survey of water works operating data for 1950, made by the American Water Works Association, indicate that for the 387 cities covered, water production varied from a minimum of 51 to a maximum of 446 gallons per capita per day, with a mean of 138 gpcd. The mean sales figure for these cities was 110 gpcd.

These average daily figures, although generally useful, are not necessarily valid for any specific city. Evaluation of the adequacy of a distribution system requires the determination of the probable maximum hourly rate of delivery for the specific system under investigation. If this information cannot be obtained from operating records, it can be developed from detailed analyses of customer usage throughout the system. Use of generally accepted ratios in computing system-wide maximum short-period demands from annual average daily demands may give erroneous results when applied to a specific system.

In estimating future maximum rates of water consumption, recent upward trends in the customer rate of use should be recognized. In the period 1945-1950 the average annual customer use rate increased approximately 10 per cent; in many cities, particularly where air conditioning is extensively used, the increase was even greater.

The domestic customer use rate has been increased by the greatly increased use of water for lawn sprinkling, by the rapidly expanding use of household garbage grinding devices, and by the use of air conditioning equipment in areas where summers are hot and dry. Continuation of this upward trend can be expected as long as the general economic status of the populace remains at a high level.

The commercial customer use rate has been greatly increased by the use of air conditioning equipment. Although many such installations are not provided with water-conserving equipment, therefore, limitations of water supply and distribution facilities have prompted many cities to require the inclusion of water-conserving equipment in all new installations having a rated capacity of more than two tons.

Recent studies of prospective future peak demands on the water distribution system at Kansas City, Missouri, indicate that the peak day water requirement, exclusive of air conditioning demands, in 1970, will be 184 mgd, while the peak day total requirement, including air conditioning use, in that year, will be 308 mgd. Thus, the operation of air conditioning equipment, even though a large percentage of it is of a water-conserving type, will increase the peak day customer demand by 67 per cent.

Fire Flow Requirements

Fire flow requirements must be considered, in evaluating the adequacy of a distribution system, since they are imposed on the peak day customer demand. Although the quantity actually used for fire fighting over a yearly period is small in relation to the total customer use, the rate of use during the period of a serious fire is large.

The formula used by the National Board of Fire Underwriters for determining the probable maximum fire demand rate in the high-value area of cities up to 200,000 population relates this peak rate to the population of the city. The results obtained by application of this formula have been widely accepted by engineers and used as a basis for the design of water distribution systems to serve such high-value areas.

The maximum demand on a distribution system during a fire is usually taken as the average customer use on the maximum day plus the fire demand as calculated by means of the Underwriters' formula. For cities of more than 200,000 population, the maximum fire-flow demand is taken as 12,000 gpm, for a single fire in the high-value area, with an additional demand of 2,000 to 8,000 gpm for a simultaneous fire outside this area.

Adequate Pressures

To be considered adequate, pressures in a distribution system must be 25 to 40 psi in residential districts containing dwellings up to four stories in height, and 75 psi in commercial districts. The American Water Works Association recommends normal static pressures of 60 to 75 psi as sufficient to supply normal uses in buildings up to ten stories in height, effective sprinkler system service in buildings up to five stories high, direct hydrant service for a minimum number of fire hose streams, and to allow some margin for local pressure fluctuations caused by sudden heavy drafts on the system.

Distribution Storage

The proper functioning of a water distribution system is materially facilitated by the use of water storage structures, reservoirs, stand pipes, and elevated tanks. Such storage, if at the pressure plane of the service area, can be used to equalize pumping rates at the supply works; a practice which permits the use of more economical main sizes and results in minimum pumping costs.

Also, such storage constitutes a reserve supply which can be delivered into the system without further pump-

ing to meet heavy demands for fire fighting or the normal demands while emergency repairs are made in the system or supply works.

Ideally, the quantity of water stored at the pressure plane should be at least equivalent to the sum of the maximum day requirement for customer use and the required fire-flow for a period of ten hours, less the *firm* daily capacity of the system supply works; preferably it should be, say, 10 per cent in excess of this quantity. Determination of the quantity of storage required in any specific system requires detailed study of its demand and supply characteristics, and of available locations for such storage.

Generally the most effective location for distribution storage, when considered as a supplemental supply source, is along the perimeter of the high-consumption district at a point diametrically opposite from the high-service pumping station at the supply works. With the storage structure at such a location, head losses within the high-consumption district will be minimum, and the quantity of water which can be delivered to points within this district at suitable pressure will be maximum. If the storage structure were located at the high service pumping station, or at a point between this station and the high-consumption district, the water plane in the district at times of heavy demands would be much lower than in the former case, and the quality of service much less satisfactory. In practice, the selection of a storage structure site is not uncommonly based on considerations of availability and aesthetics rather than on sound engineering principles.

Gate Valves

From the viewpoint of distribution system operating personnel, one of the most useful items of equipment —and in some systems one of the scarcest—is the gate valve. The purpose of valves in a distribution system is to provide the means for isolating a short section of main to permit the making of repairs, often of an emergency nature, without interrupting service to more than a minimum number of customers. The National Board of Fire Underwriters recommends that gate valves be installed at such locations and spacings that "no single case of accident, breakage or repair to the pipe system, exclusive of arteries, will necessitate the shutting from service a length of pipe greater than 500 feet in high-value districts or greater than 800 feet in other sections, and will not result in shutting down an artery."

Each functionally important gate valve, such as those at each side of a stream crossing, and each gate valve 12 inch and larger in size, will justify being housed in a concrete or masonry vault, which should be large enough to provide adequate space for personnel and tools required for the operation and maintenance of the valve.

Accurate and permanent records of the locations of all valves in the system should be readily available to all operating and maintenance personnel. Such records should include complete information as to make, type, size, direction of turning to open, location, type of installation, method of operation, etc. Good records, readily available, often prove of great value in emergency situations.

Hydrants

The distribution system should be equipped with an adequate number of hydrants so located and spaced as to provide fire protection for the entire service area. Hydrants predominately in use on water systems in the United States are of the dry-barrel type and are usually equipped with two hose outlets and one pumper outlet. A number of systems have installed hydrants equipped with two pumper outlets and no hose outlets in their high-value districts.

The distribution or spacing of hydrants depends on the maximum fire flow requirement for the district under consideration. In residential areas, in which block lengths are not over 500 feet, a hydrant should be located at each street intersection. In blocks longer than 500 feet, a hydrant should be placed midway between as well as at the intersections.

In areas occupied by large apartment houses, and in mercantile and industrial districts, it may be necessary to install two, three, or even four hydrants at the intersections, as well as one or more at locations between intersections, in order to deliver the maximum fire flow requirement.

The policy of limiting the minimum size of hydrant supply branches to 6-inch and of installing gate valves in all hydrant branches, which has been adopted by many water utilities, is believed to be sound.

Maintenance of Valves and Hydrants

Continuous preventive maintenance of distribution system valves and hydrants is a "must" if these important adjuncts are to be ready to serve their appointed function at all times. Each valve and each hydrant should be carefully and thoroughly inspected and operated through a complete cycle at frequent intervals by trained personnel. The frequency of such periodic inspections varies in different systems, but generally such inspections are made yearly.

Since damage to hydrants from external forces generally occurs more frequently in the spring and summer seasons, due to street construction and repair activities and traffic mishaps, the hydrant inspection program should be accomplished during the fall. The discovery and correction of faults in the operation of hydrant barrel drains is particularly timely at this season.

Minor maintenance work, which can well be performed in connection with the hydrant inspection operation, should include lubrication of the operating nut, greasing nozzle cap threads, caulking loose nozzles, and tightening or replacing stuffing box gland packing. The addition of leak and pressure tests to the program will increase the time required for its completion possibly 20 to 25 per cent.

The valve inspection and maintenance program can be carried on at any time, although with less efficiency when streets are covered with snow. The use of power-driven valve operating equipment, preferably of the truck-mounted type powered by a takeoff from the truck engine, will greatly facilitate and speed up the progress of the program.

Maintenance work which can be performed by the inspection crew on buried valves is limited to cleaning out valve boxes and adjusting their height. Such work on valves in vaults will include tightening or replacing stuffing box packing, and cleaning and lubricating valve operating gears.

Meters

Meters, both customer and those used for totalizing pumpage, etc., are a very essential part of any distribution system. No attempt is made here to discuss details of these meters. It is desired, however, to emphasize their value and importance in reducing waste in customer usage and in providing data which enable proper checks to be made of the efficiency of the distribution system. In addition to meters, pressure gauges of suitable design and number are an essential feature of a well-operated system.

The much-discussed question of the use of meters on private fire protection services as a means of reducing unaccounted-for water, dis-

couraging the still not infrequent attempt to steal water through such services, and, in some instances, to control maximum demands for legitimate uses, seems to be as far from a generally acceptable answer as ever. The literature of the industry is replete with accounts of the discovering of unauthorized connections to private fire lines, through which great quantities of water were being taken without compensation to the utility.

In recent years fire service type meters have been designed which will accurately measure all flows and which, since they impose practically no obstruction to full flow through the service line, satisfy all the requirements of the National Fire Protection Association.* With such meters available, it is somewhat difficult to understand the failure of water works management generally to adopt a policy requiring the installation of such equipment on all private fire services.

Many water utility operators, the owners of properties having private fire services, and the fire underwriters generally, oppose the use of fire flow meters on the premise that the additional revenue to the utility resulting from their use would not be sufficient to offset the cost of providing and maintaining the metering installations; that frequent inspections by water utility, public fire department, and underwriters' personnel will discover conditions under which the use of water for purposes other than fire-fighting or testing may or does occur.

The utility operators who favor metering all private fire lines contend that the reduction in operating costs resulting from the decrease in "free" or "lost" water effected by metering more than offsets the costs to the utility for operating and maintaining such metering installations, it being the general practice of these utilities to collect the cost of the meter installation from the customer. They consider, also, that even though unauthorized uses of water are detected by metering and such uses are discontinued, the very existence of the meters can be credited as making available for legitimate uses, at low cost, considerable system capacity previously committed to non-revenue-producing functions.

It is almost universally the policy of water utilities, both public and private, to furnish water for fire-fighting uses without charge, whether through public fire hydrants or through private fire lines. It is not the wish or intention of proponents of private fire line metering to change the status quo in this respect. With this position the author is in complete agreement.

* N.F.P.A. Handbook of Fire Protection, 10th Edition, p. 814.

"How to finance water main extensions to serve new customers is one of the oldest and most difficult of the unsolved problems confronting the water works industry. Such extensions must be reviewed in the light of legal, financial, and planning effects on the existing and potental orderly enlargement of the city."

Service Building

The successful operation of a water distribution system requires unfailing maintenance of all of its parts. Meters must be inspected, tested, cleaned, and overhauled at frequent intervals to restore their accuracy of measurement. Valves and hydrants damaged in service, or which have become inoperative for any reason, must be repaired. Many distribution departments find it more economical and satisfactory to maintain automotive and heavy construction equipment in their own shops than to depend on commercial shops for this service. Department supplies must be adequately stored and properly accounted for to prevent loss and damage.

In the past, these activities all too frequently have been housed in wholly unsuitable structures, such as abandoned fire, police or pumping stations, dismantled steam boiler plants, etc. More recently, however, water works management, in general, has come to recognize the necessity of providing adequate housing and facilities for the distribution maintenance operations. Many smaller systems, serving as few as 5,000 customers, will be found to have well-designed and equipped service buildings. Larger systems may have several such buildings, each serving a specific district or part of the system.

Local conditions and requirements will control the location, dimensions, equipment and architectural treatment for a specific service building. The influence of these criteria can best be explained by describing briefly such an installation recently completed to meet the needs of a distribution system serving approximately 40,000 customers in a South Atlantic state.

The utility constructs all distribution and feeder mains 16 inches and smaller with its own forces and equipment, and operates 18 automotive vehicles. The service building, equipment shed, and pipe yard occupy a fenced 4-acre site located at the geographical center of the distribution system and served by a railroad spur and a paved street. The maintenance building, a one-story brick masonry structure with concrete floor and roof slabs, has a gross floor area of 8,540 square feet. Allotment of net floor space within the building is:

Use	Area, Sq. Ft.
Meter Shop	1,250
Automotive Shop	3,200
Small Stores	750
Large Stores	850
Wash Rooms and Lounges	1,450
Office	400
Lobby and Corridors	500
Total	8,400

Exterior wall surfaces are of face brick, with wall copings and window sills of cut stone. Interior wall surfaces in the lobby, corridors, meter shop, lounges and washrooms are of glazed tile; those in the offices are plastered and painted and all others are of common brick.

Floor surfaces in the lobby and offices are of quarry tile; those in the lounges and washrooms are of ceramic tile; those in the meter shop, stores rooms and corridors are of cement mortar topping, and all others are of monolithic troweled finish. Ceilings, which are the exposed under side of the roof slab, are painted. Ceiling height is 10.5 feet throughout the building except in the automotive shop, where it is 15.67 feet.

Illumination for the offices, meter shop, small stores room and lounges is by fluorescent light fixtures; in all other parts of the building it is by single-lamp incandescent light fixtures. Heating is provided by a two-pipe, forced circulation, hot water system.

Service Building Equipment

The principal items of equipment are:

Meter Shop: Sand blast cleaning equipment; acid bath sinks with blower-equipped fume hood; two meter testing assemblies with calibrated tanks; two work benches; a 35-foot work table; desk and file cabinet, and meter storage racks. Compressed air

is piped to outlets on the work benches and table.

Automotive Shop: Air compressor and receiver; oil-operated single-post automotive hoist; 50-foot work bench; 2-ton, chain-operated monorail hoist. Compressed air and electrical outlets are located along the work bench.

Each Washroom: A 54-inch, foot controlled, stainless steel wash fountian; 3 water closets; 3 urinals; 2 shower stalls; water heater; 20 steel lockers; two 8-foot benches.

Large Stores Room: Chain-operated, 1½ ton, monorail hoist.

Yard Facilities

The maintenance building yard is paved for a distance of 140 feet with asphalt penetrated crushed stone. In this paved area is an automotive fuel service station, with pumps and underground storage tanks for gasoline, kerosene and diesel fuel. The equipment parking shed, a brick masonry structure 84 feet by 21 feet in plan with concrete roof and columns and clear headroom of 10 feet, is located along the rear of the paved yard area. This shed provides storage space for eight pieces of equipment.

The pipe storage yard, a graded area roughly 500 feet by 200 feet in dimensions, adjoins the maintenance building paved yard. Three parallel crushed stone driveways extend longitudinally through the pipe yard area.

Planned Layout

Meters brought in for testing and overhaul are unloaded onto a small concrete loading dock at truck-bed level, where they may be washed with a hose before being taken into the meter shop. Materials and supplies to be handled in the small and large stores rooms are unloaded onto a roofed concrete dock, also at truck-bed level, extending the full length of the exterior wall of these rooms.

The cost of this project, exclusive of site acquisition and fencing, was approximately $170,000.

Careful planning to meet functional requirements is apparent throughout this installation. Consideration of employee comfort and welfare is exemplified by the provision of modern and adequate wash and lounge rooms. The results are evident in improved efficiency of operations, as well as in high morale.

Water Main Extension Policy

Throughout the history of the industry water utility management has been faced with demands for water main extensions to serve new customers. Such demands have varied in importance from the opening of a single block of street in a well-grid-ironed system, to the development of large suburban subdivisions evolving into communities containing hundreds or even thousands of dwelling units.

How to finance such extensions is perhaps one of the oldest and most difficult of the unsolved problems confronting the industry. In addition to financing, the problem often involves factors relating to legal requirements and limitations; the implied or asserted obligation of the utility to provide water service throughout its primary service area and in areas contiguous thereto; limitations of capacity in the utility's existing production works and distribution system, and the possible effects of the development of suburban communities upon the status of existing residential and commercial districts within the parent city, as well as upon the plans of the parent city relating to annexation of these areas in connection with future orderly enlargement of the city.

It is perhaps quite generally thought that a water utility, either public or private, is obligated to extend its service to any area within the corporate limits of the municipality it serves, although it is recognized that the utility should not be expected to finance such extensions unless the anticipated net operating revenues resulting therefrom will be sufficient to amortize the required investment.

As to the question of extending water service into fringe areas outside the boundaries of the parent city; it is not likely that a utility is definitely obligated to serve such areas in the first instance, although in some states (Pennsylvania and Massachusetts among others) it may be obligated to expand its suburban service if it has already extended service beyond its boundaries. Whether or not a privately owned utility can be required to extend its service into suburban areas depends upon local laws, its charter or franchise provisions, state regulatory commission requirements, established precedents, and other local circumstances. To require such a utility to so extend its service, if the revenues to be derived from the extension would not be sufficient to support the necessary investment, would amount to confiscation of its property.

There is wide diversity in the practices and policies of water utilities regarding the making of water main extensions. The American Water Works Association, through the activity of its committee on Water Main Extension Policy, has been studying the legal, financial and civic aspects of the problem. The final report of this committee, yet to be published, will, it is hoped, serve as a guide to utility management in establishing procedures for administering main extension programs. A committee of the National Association of Railroad and Utility Commissioners is engaged in developing a set of uniform rules applicable to the operation of water utilities, which will include a recommended standard practice in relation to main extensions, and which will be recommended by that Association for adoption by state regulatory bodies.

System Check-Ups

The foregoing discussion has been limited generally to physical parts of the distribution. But system check-ups constitute a very important item in connection with operation. Constant study should be given to the matter of maintaining adequate pressures throughout the system, and this in turn directly concerns the matter of adequate main capacities. Therefore, system surveys to determine pipe capacities, operating pressures, etc., are essential to proper operating.

These surveys are usually made with the pitometer. The data obtained disclose the hydraulic properties of the mains (i.e., friction coefficients, etc.), as well as leakage. In large systems such surveys are generally carried on more or less continuously. In smaller cities they can be made less frequently. Between such surveys, constant attention should be given to such items as pressures, lost and unaccounted for water, incrustation of pipe, etc.

Distribution System Costs

The term "cost," as related to a fully adequate and satisfactory distribution system, can be discussed only in broad generalities. It may be considered from the viewpoint of the total capital investment, or the historical cost, or from the viewpoint of the cost of reproducing an existing system at present day prices.

On the historical cost, or invested capital basis, Howson* in a 1946 study of statistics on 100 water works systems found that the average per customer investment in water works plant had increased from $238 in 1925 to $310 in 1945. These 100 systems served 1,500,000 customers in the earlier year and more than 1,900,000 customers in 1946. If, on the average, the investment in distribution system were taken as two-thirds

* AWWA Journal, Vol. 38, pp. 739-749.

of the total plant investment, the per customer investment in distribution facilities would be $159 for 1925 and $207 for 1945.

Analysis of data presented in a report of the American Water Works Association indicates that in 1950 the mean book value per customer account, undepreciated, or the invested capital in water works plant, per customer account, varied by population groups from $254 for the smaller cities to $504 for cities over 500,000 population. Results of this analysis are given in Table 1.

Again, if the book value of distribution system facilities is taken as two-thirds of the total plant investment, the mean 1950 book value per customer account for these facilities by population groups was:

Group	Mean Book Value per Customer Acct.	
	Total Plant	Distribution Facilities
1	$254.14	$169.44
2	273.35	182.24
3	295.26	196.85
4	311.32	207.56
5	409.78	273.20
6	503.93	335.97

†Survey of Operating Data for Water Works in 1950, AWWA Journal, June 1953.

A study of nine recent appraisals of water distribution properties indicates per customer costs, based on present construction prices, ranging from $240.56 to $507.06, the weighted average being $348.66. The cost of reproduction new for each of these properties was determined by applying construction prices current at each location on July 1, 1954, to actual inventories.

TABLE 1
Capital Investment in Water Works Plant

Group	Population Range, 1,000's	No. of Plants	Total Pop. Served, 1,000's	Customer Accounts, 1,000's	Av. Persons per Account	Mean Book Value Per Capita*	Mean Book Value Per Customer
1	10 to 25	124	2,109	548	3.85	$66.01	$254.14
2	25 to 50	96	3,434	825	4.16	65.71	273.35
3	50 to 100	57	3,861	873	4.42	66.80	295.26
4	100 to 250	44	6,851	1,445	4.74	65.68	311.32
5	250 to 500	27	9,515	1,982	4.80	85.37	409.78
6	Over 500	18	25,398	3,724	6.82	73.89	503.93

*From Table 25, AWWA Journal, Vol. 45, p. 1330.

Although these figures indicate the costs of specific distribution systems at present day prices, and although they may serve to establish limits between which the actual cost per customer for any distribution system may fall, the characteristics of distribution systems are so diverse that average cost units derived from a study of any one such system cannot be applied with assurance to any other system.

A fully adequate and satisfactory water distribution system is a rarity. Changing developments in land usage within or contiguous to the primary service area and the continuing upward trend in the use of water by the public, impose ever-increasing demands on the capacity of the system. Distribution facilities which a decade ago may have been considered as substantially adequate and satisfactory may in some respects be wholly inadequate to meet today's demands. Continual improvement of the system, by the installation of additional feeder mains, distribution storage, distribution pumping stations, and appurtenant facilities is necessary to maintain its adequacy.

Alert management will, by constant analysis of current and prospective demands, be cognizant of existing and developing inadequacies in distribution facilities, and will maintain a well-planned program of improvements to correct these inadequacies. Alert management also will keep its patrons fully informed as to the need for such improvements, the capital investment required, and the additional revenue which they must pay to support the additional investment. They make the decision as to whether the value of the more adequate service which the improved system will provide will justify the required investment and any proposed increase in rates.

W&SW

Gordon Yaxley Retires

Thirty-four years as Superintendent of Water at Waterford, N. Y.

R. Gordon Yaxley retired as superintendent of water works at Waterford, N. Y., on July 1, completing 34 years of service to the community. An operator of unusual ability and inventive bent, he has frequently enriched the field with information passed on in water works meetings and in articles of practical value published in the technical press. In recognition of these attributes, Mr. Yaxley was amongst the earliest recipients of the George W. Fuller Achievement Award of the AWWA in 1941.

Mr. Yaxley was born on a western New York farm seventy-one years ago. His mechanical experience began at 8 years when after school hours he fired the boiler in his father's grist mill. He was later chief engineer of an industrial power plant and still later was in charge of operation and maintenance of locks on the N. Y. State Barge Canal.

In 1921, Mr. Yaxley accepted the job of converting the Waterford, N. Y., water plants from steam to electric operation. The Waterford Board of Water Commissioners, realizing that they had a "nugget," persuaded Mr. Yaxley to stay on as superintendent of water and he has worn well these thirty-four years since.

A Knight Templar Mason, and highly regarded by his townspeople, Mr. Yaxley has this to say of himself — "starting as boiler fireman when eight years old, I've had grease on my hands most of the time since —some hard work, some headaches, a lot of fun and the privilege in the water business of making many friends."

A man of inquisitive mind, inventive ability and sincerity of purpose, Gordon Yaxley will ever remain a water works man, regardless of what a well earned retirement may hold for him—and, we hope that will be a lot.

Deepest Well Produces Water . . . but Oil Was Wanted

The world's deepest well—a 21,485-foot hole near Bakersfield, Calif. —has been abandoned because it produced only water instead of oil. Loss on the venture will run more than $2,000,000, according to a spokesman for the Ohio Oil Co.

HAND DIPPING removes grease, descales and brightens meters.

ENCRUSTED meter (left) is restored to "like new" condition (right).

Three Dips—and the Water Meter is Cleaned

Experience at Hamtramck, Mich., has demonstrated the simplicity and effectiveness of solvents designed to recondition meters

by ALEXANDER SMOLENSKI

Water Service Supervisor
City of Hamtramck, Mich.

FEW MUNICIPAL functions are as efficiently administered as that of public water supply. Further economies in that field are difficult to effect. A small but important economy practiced by the City of Hamtramck, Mich., which should be of general interest is its meter reconditioning program.

Water meters, like any other equipment, represent a substantial investment on the part of the city. Too frequently they are an investment that is out of sight and, unfortunately, out of mind. But since the city of Hamtramck inaugurated its modern program of meter restoration, it has realized substantial economies and has immeasurably improved the quality of its reconditioning work. The simple process which we employ first came to the attention of the writer at the AWWA Convention in Chicago, in 1949. Known as the "Kelite Dip Method," it has become our standard method for renovating Badger, Worthington-Gamon and Federal Meters.

The term "dip-method" is an accurate description of the procedure. All cleaning, descaling, brightening, etc., is accomplished solely by dipping the component parts of the meters into successive liquids designed specifically for the job. Since there is no special equipment required, the cost of inaugurating the program in a city the size of Hamtramck amounts to the price of three five-gallon earthenware containers plus the modest cost of the liquids.

In "dip reconditioning" the first step is the complete disassembly of the meter. Obviously, this operation

INEXPENSIVE equipment is required to restore meter's condition in rotational servicing program.

is required regardless of what method of reconditioning is used. The disassembled meter parts are then placed in a small wire basket and dipped consecutively into the three room-temperature solutions, with hot water rinses between each dipping. Reassembly follows the final dip.

The first dip is for the purpose of dissolving gummy, oily or greasy accumulations. The liquid employed is a commercial solvent known as Kelite Formula 555. Like all the liquids used in the process, it is non-flammable and requires no heat. When used according to directions, it is harmless to all metals used in water meter construction.

The second dip is for the purpose of dissolving the rust and mineral scale deposits so frequently the cause of excessive wear or stoppage. This is accomplished by means of a solution known as Scale-Off.

It will be noted at this point in the process that, while thoroughly clean, the metals have been tarnished by the chemical rust and scale remover. The tarnish is, however, a superficial condition and is readily removed by immersion of the parts in the third and final dip. This last solution, Metal-Brite, has a sterilizing as well as a brightening action. Rinsed and dried, the parts are found to be bright and clean as new—ready for reassembly.

According to the recommendations of the AWWA, water meters should be checked and tested every seven years. A city of 43,300 citizens, Hamtramck requires 7,700 meters to maintain its 100 per cent metered service. This means that we have the routine job of reconditioning 1100 meters a year, *plus* the usual repairs and reconditioning jobs occasioned by failures, stoppages, etc. Such a program would be an involved and costly undertaking for our small community were it not for this new development in cleaning metal parts. With it, however, we have been able to prove that new economies are possible.

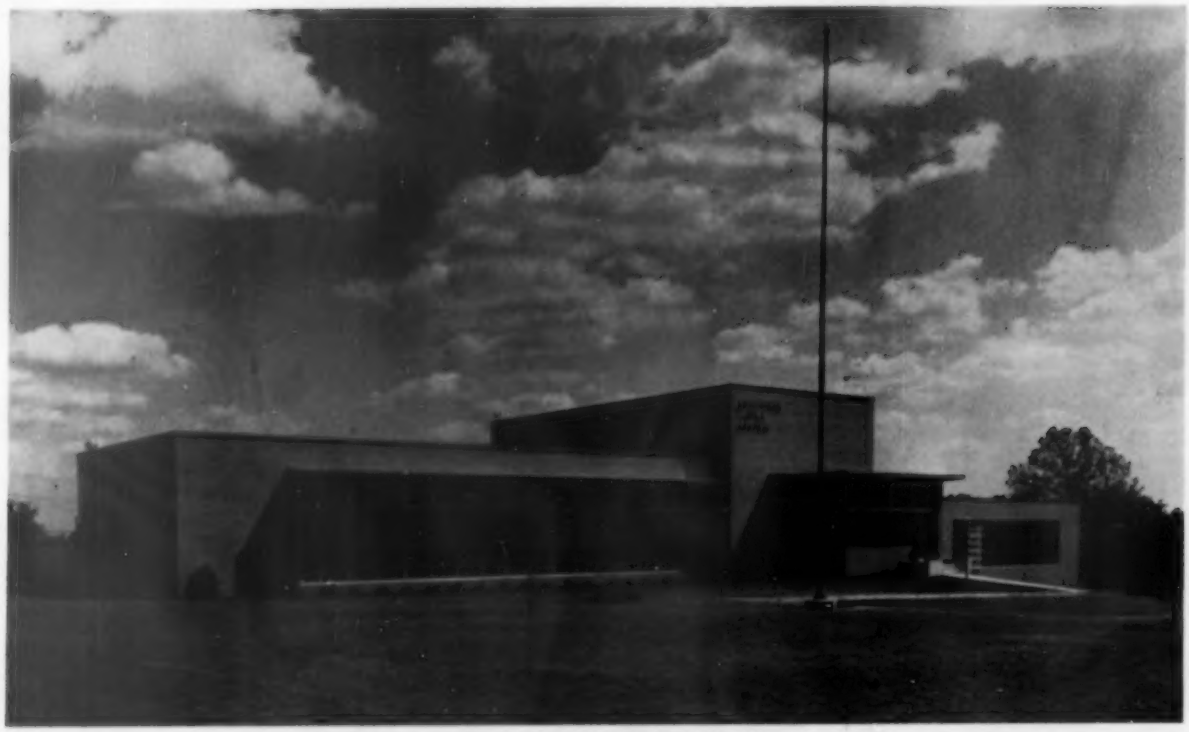
W&SW

Decontamination of Radioactive Water by Ion Exchange Slurry Method

The possibility of radioactive contamination of public water supplies from the use of nuclear weapons or from improper disposal of waste from atomic reactor installations, research organizations or hospitals has emphasized investigations of methods of dealing with such contamination.

Removal of radioactive contaminants from water by ion exchange slurry is among the latest of these methods tested by the Sanitary Engineering Branch of the Corps of Engineer's Research and Development Laboratories, Fort Belvoir, Va.

Tests indicated that under certain conditions the ion exchange batch slurry treatment decontaminates radioactivity contaminated water to a level suitable for emergency drinking purposes within 30 minutes. Because equilibrium is reached rapidly in the batch treatment it is faster, although sometimes less efficient, than the column type operation in which ion exchange materials are also used.



MODERN 5 mgd filtration plant of the Columbia water system.

New Water Supply Facilities For Columbia, Tenn.

by A. B. JOWERS

Mr. Jowers is project engineer with Polk, Powell and Hendon, Engineers, water and sewage consultants. He holds a civil engineering degree from the Univ. of Alabama and, after two years in the Army Air Force, received his M.S. degree in sanitary engineering from the same university.

THE City of Columbia recently placed in operation a new 5.0 mgd water filtration plant, which relieved a serious water shortage in one of Central Tennessee's fastest growing small, industrial cities.

The Columbia water system served a 1951 population of more than 16,000, which is expected to reach 22,000 by 1961. In addition to supplying the usual domestic and commercial water requirements, the system now holds contracts to supply 1.5 million gallons of water per day direct to local industries. By the summer of 1951 its filtration plant and other parts of the system had become seriously overloaded in attempting to supply sufficient water to new industries and to a fast growing population.

The Board of Public Utilities was confronted with the very urgent problem of supplying the city's water requirements, either by expanding an old filtration plant or by building an entirely new plant with all appurtenant facilities.

History of the Supply

Records of the early history of Columbia's water system are not complete, but they indicate that the original supply facilities were constructed in 1875 on the left bank of the Duck River, a sizeable stream which flows through the city. The original installation consisted of a steam-powered pumping station which drew water from the river and pumped it directly into the distribution system without treatment. The consumers at that time were provided with small house filters. In 1915 a settling basin and three filters were built adjacent to the pumping station. The pumping equipment was converted from steam to electric power in 1929. Very few other improvements were made in the plant until 1944, although the distribution system was gradually extended with the growth of the city.

The system was owned and operated by the Tennessee Utilities Corporation up to May 7, 1941, at which time the city of Columbia acquired all of the water properties. Concur-

rently with this purchase, the Board of Commissioners of the city of Columbia substituted the "Board of Public Utilities" for the then existing "Board of Waterworks and Sewerage Commissioners," and vested in the new board full jurisdiction over the entire water system. The properties then became officially known as the "Columbia Water System."

During the year 1944, the capacity of the filtration plant was increased by enlarging the settling basin, by adding new filters and another clear well, and by installing additional pumps. Additional filters were again constructed in 1948.

In February, 1948, the filtration plant was forced out of operation by a flood, the greatest in the recorded history of the Duck River. The water reached a maximum elevation of 587.27 feet above mean sea level, which was approximately 45 feet above the normal stage. Because of this flood the filtration plant was out of operation for five days, during which time portable army filtration plants were pressed into service to provide water for minimum domestic needs.

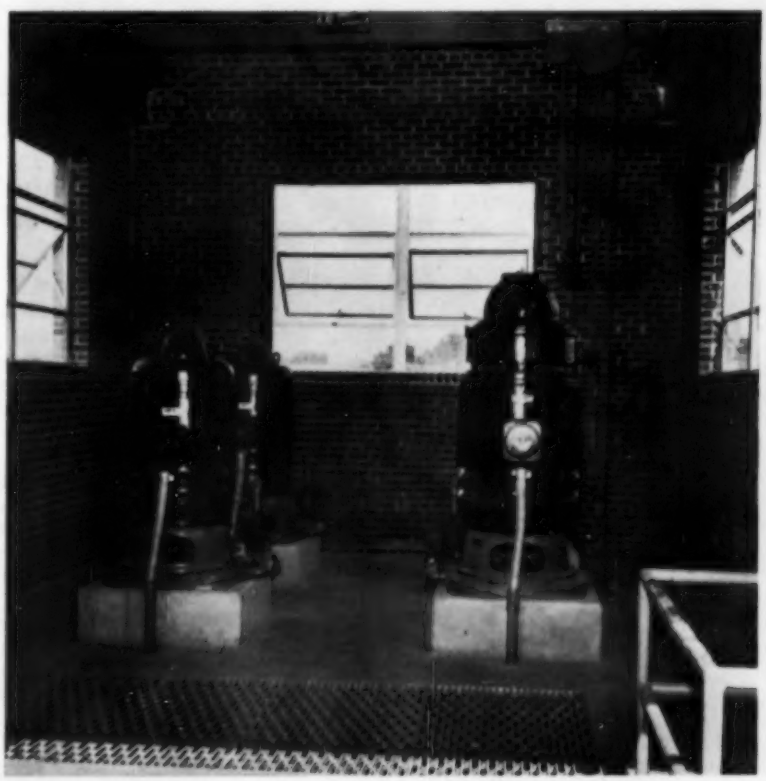
Old Filtration Plant Overloaded

During the summer of 1951, the filtration plant was operated around-the-clock, time being lost only for backwashing filters, draining the settling basin, and for repairs. The capacity of the filters, based on the conventional rate of 2 gal. per min. per square foot of sand area, was about 2.7 mgd; however, the retention period in the settling basin when operating at this rate was only 2.75 hours, which is considerably lower than the 4-hour minimum retention period required in Tennessee.

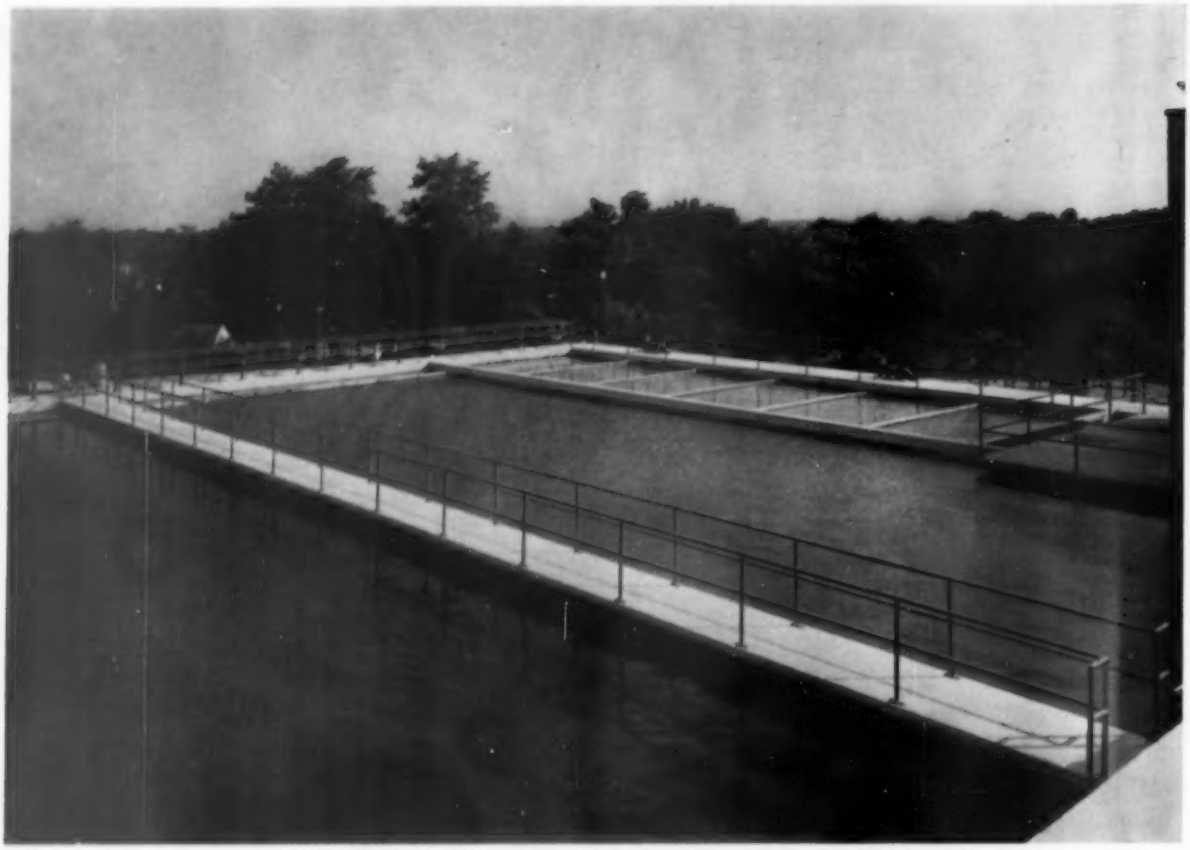
Unfortunately, the site upon which the plant was built is small in area and space for expansion was very limited. The topography of the site is unfavorable for additional expansion, and excavation for new settling basins and filters would necessarily have to be made in rock for the entire depth of the new structures.

Another unfavorable factor in considering additional expansion on this site is the fact that the growth of the city has reached to a considerable distance upstream along the Duck River, leaving the plant intake structure on the downstream side of several sanitary sewers that discharge directly into the river. Moving the intake upstream to avoid sewage pollution would be an expensive project because of the extremely rough terrain and almost solid rock along the route of a connecting raw water line to

ELECTRIC control panel from which all small motors, pumps and lighting and heating panels can be operated.



PUMPS at intake station for lifting raw water from the Duck River to the filtration plant. These are vertical turbine type units.



SETTLING and flocculating units. Detention in flocculators is 45 minutes; in settling basins four hours.

the plant. A new pumping station near the upstream intake would also be required.

Another important consideration involved was the problem of protecting the existing and any additional facilities from future floods. This could have been accomplished but was not feasible from an economic standpoint.

These factors together with comparative cost studies clearly indicated the desirability of abandoning the existing river intake and filtration plant and of constructing entirely new facilities.

New Water Supply Facilities

Acting upon recommendations of its engineering consultants, the Board of Public Utilities decided to undertake a comprehensive construction program planned to assure the city of Columbia a safe and abundant supply of water.

On November 12, 1952, bids were taken on a new river intake and raw water pumping station, a raw water line, a filtration plant, a filtered water line to the distribution system, and two storage reservoirs. Contracts were let on all of these items except one storage reservoir, which will be built in the near future. Construction work was begun on parts of the work in March, 1953. The project was completed and the filtration plant placed in operation in July, 1954.

Raw Water Pumping Station

The pumping station and river intake were built in the same structure, approximately one mile upstream from the old intake. This location is also upstream from a small impounding dam, owned by the Tennessee Valley Authority, which provides a considerable amount of storage and creates the necessary water depth during periods of low river flow. All the city's sanitary sewers which discharge into the river are downstream from the pumping station and dam.

The dam structure is of circular reinforced concrete design, from its foundation to the main floor at street level, and is anchored to solid rock. The water intake sections are provided with bar screens. The over-all height of concrete above the foundation is 69.5 feet. Over the main floor level is a brick building, rectangular in shape, which houses the pump motors and their electric controls.

The three pumping units are vertical turbine type pumps, two having capacities of 2.5 mgd each and the third of 3.75 mgd. Space is provided for one future pump. Hoisting equipment is included for pump maintenance.

New 5 Mgd. Filtration Plant

The filtration plant is located one-half mile from the raw water pumping station, and approximately one mile north of the downtown business district of the city, on U. S. Highway 31. The land purchased for the site provides ample space for economical future plant expansion.

Water enters the plant at a mechanical flash mixer, where coagulating chemicals and chlorine are introduced, and flows to a mechanical flocculating basin. The flocculating basin has a retention period of 45 minutes when operating at a 5 mgd rate. Variable speed drives on the flocculators make available peripheral paddle speeds ranging from 0.5 to 1.5 fps.

The water next flows to two settling basins, each 43 feet wide and

108 feet long, having a water depth of 12 feet. Based on the five mgd designed capacity, the retention period in these units is four hours.

There are four filters, each having a capacity of 1.25 mgd when operating at the usual rate of 2 gal. per min. per square foot of sand area. Each filter is equipped with Wheeler precast underdrains, a surface wash system, a single rate controller, and conventional loss of head and rate of flow gauges. Each group of two filters and one settling basin have the same overall width, and are designed to comprise a single treating unit. This arrangement of filters and settling basins is presently convenient and is economical for future expansion. The space between the filters and settling basins has been utilized for conduits, the top section of which serves for filter inlets and the lower for backwash waste water.

Three Floor Levels Provided

The filter building has three floor levels. The first floor contains the filter pipe gallery and pump room, a small repair shop, a locked storage room, and a garage with inside loading platform. The second floor provides space for the filters, filter operating tables and electric controls, rooms for the chemical feeders, chlorinators, and the office and laboratory. The third floor is for chemical storage.

Chemical feeding equipment consists of two lime feeders, one alum feeder, one fluoride feeder, and one feeder which can be used for lime, alum, or activated carbon. All are of the volumetric type, except the fluoride feeder which is a gravimetric machine. Each is equipped with a dust collecting mechanism, and has a hopper which extends to the third floor floor for loading. Separate locked rooms are provided for the fluoride feeder and for fluoride storage.

Two chlorinators are installed and space provided for a third which may be removed from the old plant. Adjacent to the chlorinator location is a separate room for weighing scales and chlorine storage. Chlorine cylinders as well as other chemicals are lifted from a loading platform on the first floor by a freight elevator.

A modern laboratory, located adjacent to the office, provides facilities for bacteriological and chemical examinations.

Finished Water Pumping

The capacities of the high service pumps are coordinated with filter capacities and are identical to those of the raw water pumps. Two pumps

OPERATING floor of the filtration plant. The four filters and two settling basins are designed as two separate units.

CHEMICAL feeders, three of five units. Two regularly feed lime, one alum, one fluoride, and one lime or alum or activated carbon.

LABORATORY, located adjacent to plant office, is equipped for chemical and bacteriological examination of water. This is the chemical workbench.

CONTRACTORS AND EQUIPMENT SUPPLIERS

Contractors

Filtration Plant and Raw Water Pumping Station	G. E. Moore Company, Inc. Greenwood, South Carolina
Pipe Lines	Bush Building Company Nashville, Tennessee
Reservoir	Pressure Concrete Company Florence, Alabama

Equipment Suppliers

Mixer and Flocculators	Walker Process Equipment, Inc.
Filter Gages, Controllers and Meters	Simplex Valve and Meter Co.
Filter Underdrains	Builders-Providence, Inc.
Operating Tables	Builders-Providence, Inc.
Chemical Feeders	Wallace & Tiernan Co., Inc.
Chlorinators	Wallace & Tiernan Co., Inc.
Pumps	Fairbanks, Morse & Co.
Gate and Check Valves	M & H Valve & Fittings Co.
Sluice Gates	Chapman Valve Mfg. Co.
Cast Iron Pipe	American Cast Iron Pipe Co.
Electric Switchgear	Westinghouse Electric Corp.
Laboratory Furniture	Metalab Equipment Corp.

each have capacities of 2.5 mgd, which equals the rated output of two filters. The third pump has a capacity of 3.75 mgd, which equals the rated output of three filters. The full filter output of 5 mgd can be pumped by combined operation of any two of the three pumps. The maximum pumping head is 225 feet. The high service pumps as well as the wash water pump are of the vertical turbine type. Space has been provided for one future pump.

For the purposes of preventing surge pressures and releasing the air in the pump columns, small motor-operated by-pass valves were installed on each high service pump discharge, immediately behind the check valves. These by-pass valves operate automatically when the pumps are started or stopped. When the pushbutton is operated to start the pump, the by-pass valve begins to open and as it reaches a fully open position the pump starts and the entire pump discharge is by-passed, expelling all the air from the column. After the pump is in operation, the by-pass valve automatically closes, allowing pumped water to enter the distribution system very slowly; this sequence entirely eliminates surging. In stopping a pump, the by-pass valve opens slowly; when a fully open position is reached, the pump stops. The by-pass valve then closes. The operation of these particular valves has been very satisfactory.

The clear well is a circular concrete structure having a capacity of 400,000 gallons, and is located outside of the filter building near the high service and wash water pumps.

Starting Plant Operations

In putting the plant into operation, minor difficulties were experienced with the raw water pumps and the flocculator equipment. The factory-recommended method of releasing air from the columns of the raw water pumps by the use of small inverted check valves was not satisfactory. This problem was corrected by replacing the check valves with Crispen air and vacuum valves. The automatic lubricating mechanism on the flocculators was over-designed, which allowed excessive quantities of grease to pass the underwater shaft bearings. This mechanism is being replaced.

Initial operating results have been very satisfactory. With about 60 ppm turbidity present in the raw water during dry weather flow, good coagulation is accomplished by feeding 1.7 grains per gallons of alum and 0.7 grains per gallon of lime. Because of improved chemical feeding and mixing, the dosages of alum and lime are substantially lower than those used in the old plant. Turbidity in the settled water is reduced to about 1 ppm.

The storage reservoir has a capacity of 1.5 millon gallons. It is of prestressed concrete design, utilizing a thin dome type roof. It was built adjacent to the old uncovered reservoir which it replaced.

Construction Costs

The construction cost of the entire project was $1,030,594.06, not including land, rights-of-way, engineering and inspection costs. Of this total, the filtration plant amounted to $664,044.68 and the raw water pumping station $104,986.71.

Engineering consultants for the project were Polk, Powell and Hendon, Birmingham, Alabama. The writer was in direct charge of design.

W&SW

Novel Sewer Financing Method

The small southwestern Pennsylvania community of Perryopolis is going to have a modern sewer system, thanks to a woman who left about $1½ million to her home town. The benefactor, who died several years ago, stipulated that the money be used for civic improvements.

The first improvement made when the money finally became available more than a year ago was 113 new street lights.

Now the trustees of the estate have given their approval to the sewer system, estimated to cost $325,000.

Radioactivity in Ohio Waters — H-Bomb Tests Not Dangerous

Radioactivity in Cincinnati, Ohio, drinking water after the 1954 H-bomb tests in the Pacific area was "about 500 times less than the permissible levels in drinking water," according to L. R. Setter, chemist at the USPHS Taft Sanitary Engineering Center in that city. The statement was made following a report on the subject by Dr. Setter and Dr. A. S. Goldin at the recent 127th national meeting of the ACS.

According to Dr. Setter, quick techniques have been developed for figuring radioactivity in surface waters by spot checking the amount of such activity in rainfall. The techniques would be useful in monitoring drinking water supplies in the future.

The 1953 level of radioactivity in Cincinnati rain, following the Nevada atomic tests, was ten times as great as that after the 1954 Pacific tests; but it, too, was "insignificant from a public health standpoint." Tests showed that most of the originally low radioactivity in the rain was filtered out by such things as roof shingles, leaves in roof gutters and on the ground, lawn clippings, soil and vegeation.

WATER WORKS PRACTICES

Chemical Handling and Feeding - Part 1

The Twenty-second of a Series

IN THE FIELD of water purification, there are several treatment processes which involve the use of chemicals. Specific details of the application, dosage, and reaction of these chemicals will be discussed in the lectures dealing with these particular treatment processes. In this lecture, material will be presented on the general subject of chemical handling and feeding.

by GEORGE E. SYMONS, Ph.D.

Dr. Symons is Consultant and Technical Editor, Larchmont, N. Y. In this series he discusses *Water Works Practices* in the form of short course lectures. These are designed to assist plant operators, students, and all who wish to review fundamentals in this field.

A . . . Treatment Involving Chemicals

1. PROCESSES

a. Common Treatment Processes.

(1) Algae control.
(2) Coagulation (turbidity removal).
(3) Color removal.
(4) Corrosion and scale control (stabilization).
(5) Disinfection.
(6) Fluoridation.
(7) Iron and manganese removal.
(8) pH adjustment.
(9) Softening.
(10) Taste and odor control.

b. Special Treatments.

(1) Activation of silica.
(2) Boiler water treatment.
(3) Chlorine-Ammonia treatment.
(4) Dechlorination.
(5) Defluoridation.
(6) Diatomaceous earth filtration.
(7) Silica removal.
(8) Slime control.
(9) Zeolite regeneration.

2. CHEMICALS USED

a. Table 1 is a check list of 41 chemicals used in the ten common treatment processes in water works.

b. Table 2 is a check list of 29 chemicals used in treatment processes used under special conditions and for specific purposes.

B . . . Shipping Data

1. AVAILABLE FORMS

a. Dry chemicals come in various particle sizes depending on the particular chemical and its intended use.

(1) Common forms are powder, ground, and lump.

(2) Other forms are pebble, rice, granules, pellets, crystals and flakes.

b. Liquids and solutions constitute a second class of chemicals.

PACKAGE STORAGE of chemicals—note bags stored on pallets and dust collectors on dry-feeder hopper chutes.

TABLE 1
Chemicals Used in Common Water Treatment Processes*

CHEMICALS	PROCESSES									
	Algae Control (1)	Coagulation (2)	Color Removal (3)	Corrosion Control (4)	Disinfection (5)	Fluoridation (6)	Iron and Misc. Removal (7)	pH Adjustment (8)	Softening (9)	Taste and Odor Control (10)
Activated Carbon	√		√							√
Activated Silica		√								
Alum, Ammonium Sulfate		√								
Alum, Chloride		(√)								
Alum, Potassium Sulfate		√								
Aluminum Sulfate		√					√			
Alum, Liquid		√								
Ammonium Silicofluoride						√				
Bentonite		√	√							
Calcium Carbonate				√				√		
Calcium Hydroxide		√	√	√	(√)		√	√	√	
Calcium Hypochlorite					√					
Calcium Oxide		√	√	√	(√)		√	√	√	
Carbon Dioxide									√	
Chlorinated Copperas		√								
Chlorinated Lime					√					
Chlorine			√		√		√			√
Chlorine Dioxide			√		√		√			√
Copper Sulfate	√									
Disodium Phosphate				√					√	
Dolomitic Hydrated Lime								√		
Dolomitic Lime								√		
Ferric Chloride		√								
Ferric Sulfate		√								
Ferrous Sulfate		√								
Fluosilicic Acid						√				
Hydrofluoric Acid						√				
Ozone			√		√					√
Sodium Aluminate		√								
Sodium Bicarbonate								(√)		
Sodium Carbonate				√				√	√	
Sodium Chlorite					√					
Sodium Fluoride						√				
Sodium Hexametaphosphate				√						
Sodium Hydroxide		(√)		√				√	√	
Sodium Hypochlorite					√					√
Sodium Silicofluoride						√				
Sodium Sulfite				√						
Sulfuric Acid				√				√		
Tetra-Sod. Pyrophosphate				√						
Tri-Sodium Phosphate				√					√	

*Checks indicate normal uses; checks in parentheses (√) indicate potential uses usually dependent on the economics involved.

c. Gases are usually available in liquefied form under pressure.

2. CONTAINERS AND SHIPPING REQUIREMENTS

a. The particular container used for shipping chemicals depends on the type of chemical, characteristics, and properties.

b. Dry chemicals are shipped in:

(1) Bulk, in carload or less than carload lots.

(2) Packages

. . . Bags (usually multiwalled paper bags, 100 lb).

. . . Drums (25 to 375 lb).

. . . Barrels (100 to 400 lb).

c. Liquids and solutions are shipped in:

(1) Tank car lots.

(2) Truck tanks.

(3) Glass carboys.

(4) Earthware bottles.

(5) Kegs.

d. Gasses are shipped in liquefied form under pressure in steel containers.

(1) Cylinders may be 25, 105, 150 lb.

(2) Ton containers are also used for chlorine.

(3) Tank car lots (30 ton and 55 ton) and barge tanks.

e. Some chemicals are produced at the site and used as produced.

(1) Activated silica.

(2) Chlorine dioxide.

(3) Liquid alum may be produced and stored at the water works site.

f. Chemicals which are corrosive or toxic in nature are shipped in accord with ICC regulations and the shipping package must carry a distinctive label indicative of these characteristics.

C . . . Characteristics of Chemicals

1. APPEARANCE AND PROPERTIES

a. The appearance of chemicals may be of less importance to water works operators than other characteristics but information on color, dustiness, etc. is available and may be helpful in selecting the desired material.

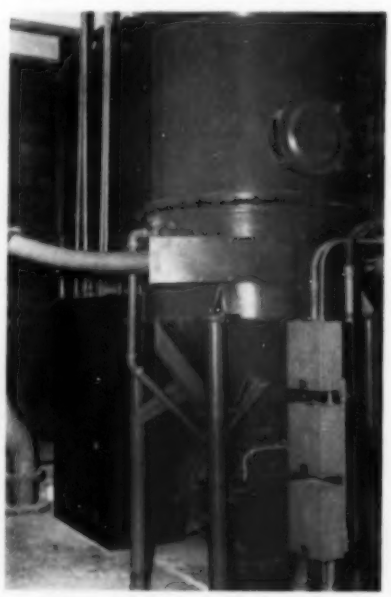
b. Properties of chemicals are important. The buyer and user should consult a good reference work in order to become acquainted with these properties, if applicable to the chemical in question:

(1) Toxicity to humans.

(2) Effect on skin.

(3) Corrosive.

(4) Explosive or fire hazard.



PNEUMATIC dry chemical conveyor.

(5) Hygroscopic, deliquescent or efflorescent.

(6) Crystaline or amorphous.

(7) Activity in presence of air or moisture.

(8) Tendency to dissolve and pH of solution.

2. Bulk Density

a. The weight per cubic foot of dry chemicals is termed bulk density.

(1) Bulk density varies depending on the particle size of the chemical and on the amount of air entrained in the material.

. . . Vibrated materials tend to become packed and increase in bulk density.

(2) It is the bulk density of a chemical which determines the storage space required and the size of the chemical feeder hopper.

b. For liquid chemicals and solutions bulk density is usually given in pounds per gallon or it may be stated in terms of degrees Baumé or specific gravity.

3. Commercial Strength

a. Chemically pure chemicals are generally used only in the laboratory. A few chemicals, however, (chlorine, ammonia, sodium carbonate, sulfur dioxide, etc.) are obtained almost pure in commercial form, but most chemicals used in water works practice contain some impurities.

b. It is important to know the per cent purity of the chemical and sometimes what the impurities are.

(1) The Am. Wat. Wks. Assn. has specifications limiting the impurities for many chemicals.

HAND TRUCK for moving chorine and ammonia cylinders.

TABLE 2
Chemicals Used in Special Water Treatment Processes

CHEMICAL	PROCESS								
	Activation of Silica (1)	Boiler Water Treatment (2)	Chlor.-Amm. Treatment (3)	Dechlorination (4)	Defluoridation (5)	Diatomaceous Earth Filter (6)	Silica Removal (7)	Slime Control (8)	Zeolite Regeneration (9)
Alum, Ammonium Sulfate			√						
Aluminum Sulfate					√				
Alum Liquid					√				
Ammonia, Anhydrous			√						
Ammonia, Aqua			√						
Ammonium Sulfate	√		√						
Barium Carbonate		√							
Calcium Hypochlorite								√	
Carbon Dioxide	√								
Chlorine	√							√	
Diatomaceous Earth						√			
Disodium Phosphate		√							
Dolomitic Hydrated Lime		√			√		√		
Dolomitic Lime		√			√		√		
Magnesium Hydroxide					√				
Magnesium Oxide					√				
Sodium Bicarbonate	√								
Sodium Bisulfite				√					
Sodium Chloride									√
Sodium Hydroxide		√							
Sodium Hypochlorite								√	
Sodium Silicate	√								
Sodium Sulfite		√		√					
Sodium Thiosulfate				√					
Sulfur Dioxide				√					
Sulfuric Acid	√								
Tetra-Sod. Pyrophosphate		√							
Tricalcium Phosphate					√				
Tri-Sodium Phosphate		√							

(2) Chemical dosages must be calculated on the basis of the actual content of chemical in the material obtained.

4. Solubility

a. Solubility of a chemical in water is important, because it is the solubility which determines the size of the dissolving chamber in dry chemical feeders, or the size of the solution tank and solution feeder where liquids are fed.

b. Solubilities are usually expressed in terms of grams of the pure chemical per 100 ml of water.

(1) Solubility generally as given in handbooks and reference texts, is the solubility of the pure chemical compound. Few exact data exist on the solubility of commercial chemicals.

(2) Solubilities in gm per 100 ml can be converted to lb per gal by multiplying by a factor of 0.0834.

(3) Solubilities vary with temperature and are generally given at four different temperatures stated in degrees centigrade. The following table reveals what these temperatures are in Fahrenheit degrees:

$0°C = 32°F$
$10°C = 50°F$
$20°C = 68°F$
$30°C = 86°F$

D . . . Handling and Storage

1. Unloading

a. Bulk chemicals.

(1) Railroad siding at plant makes possible direct transfer from carload shipments.

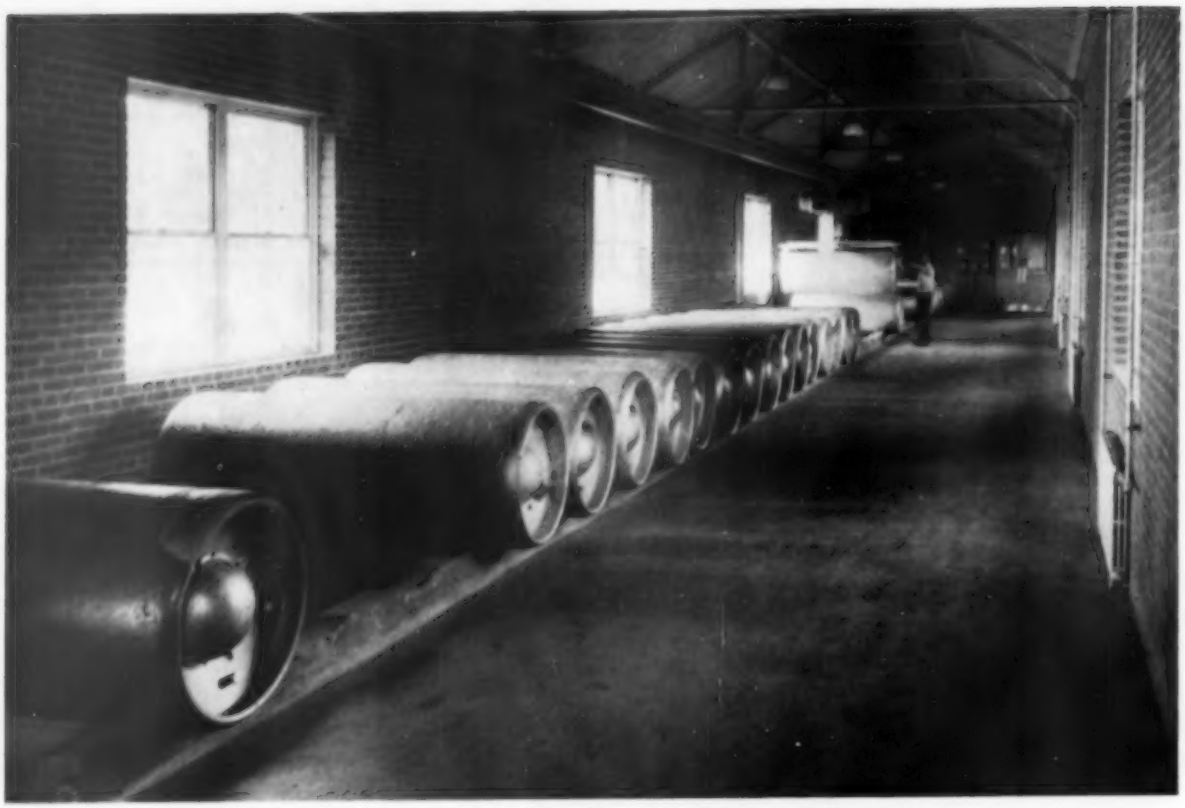
(2) Methods of transfer include:
Air conveyors
Bucket elevators
Direct dumping or shoveling

(3) Where railroad sidings are at a distance from the water plant, trucks are used for transporting chemicals from railroad car to plant storage.

(4) Freight elevators, as standby equipment, are recommended for water plants with pneumatic conveyors or bucket elevators.

b. Packaged Dry Chemicals.

(1) Bags, drums or barrels are



CHLORINE storage and handling in one-ton containers—Richmond, Va.

transferred from railroad car or truck to storage space by hand or motor truck.

(2) Bags are often placed on wooden pallets which are moved from car to storage space by a fork lift truck.

PROTECTIVE APPAREL, as worn by plant personnel unloading silicofluoride.

c. Liquids or solutions.

(1) Small containers are handled by hand, hand truck or motorized material handling truck.

(2) Bulk liquids are transferred from tank car or tank truck by air pressure or pumps.

d. Liquefied gas.

(1) Chlorine cylinders are handled by special curved back hand trucks.

(2) Ton containers are handled by special hook lift and chain hoist operating on a monorail.

(3) Chlorine containers should never be lifted by magnet, chain or rope sling, and should never be allowed to drop or to strike one another.

(4) Chlorine from tank cars is transferred to stationary storage by pressure of moisture-free and oil-free air.

2. Storage Facilities

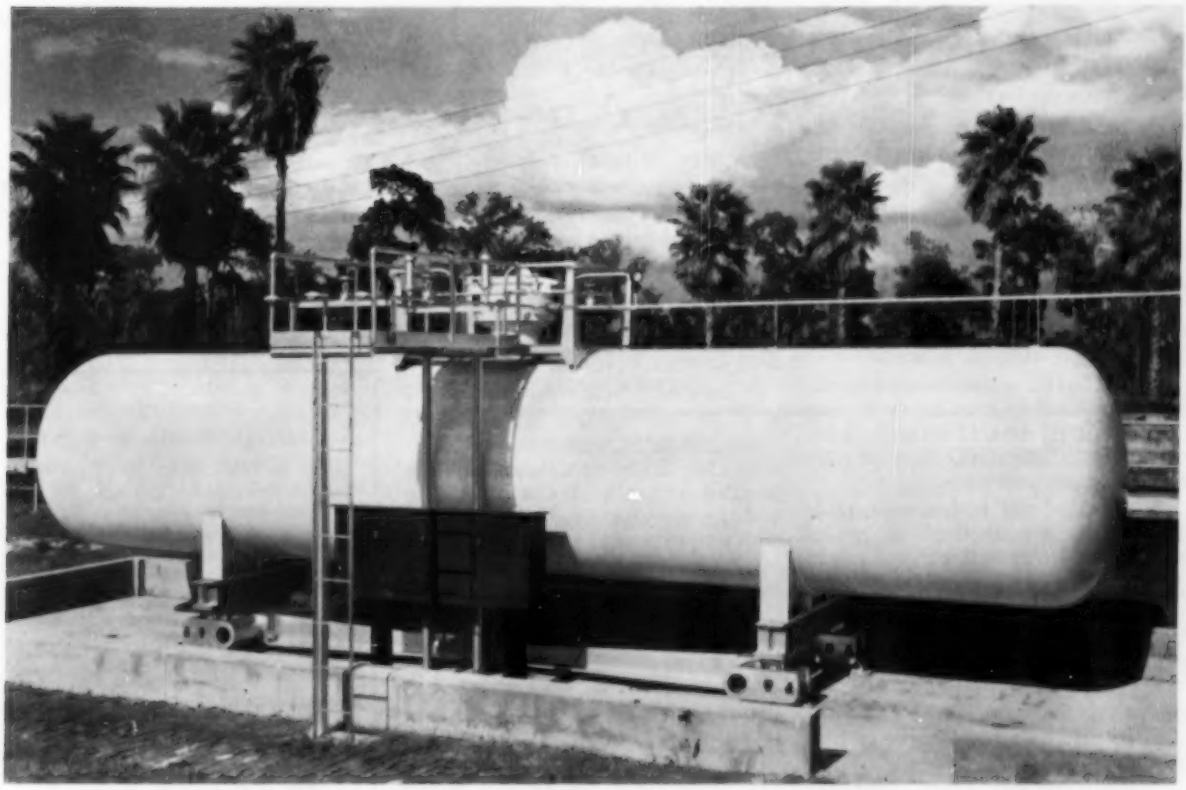
a. Dry bulk chemicals are stored in hopper-bottomed bins, circular or square, with the hopper sloping about 60 degrees with the vertical.

(1) Metal bins can be equipped with vibrators to prevent arching of the chemical.

(2) The hopper bottom is closed with a bin-gate operated manually or electrically and discharges to the hopper of the chemical feeder.

(3) Size of the storage bin is dictated by the amount of chemical required for normal operation and economics of construction and operation.

CHEMICAL FEEDER mounted on scales.



BULK STORAGE of liquid chlorine, purchased in single unit 30 ton tank cars, is a late development—Tampa, Fla.

(4) Precautions regarding bulk chemical storage are necessary only for ferrous sulfate which tends to consolidate into a hard cake on storage.

b. Packaged chemicals, particularly bags and fiber drums are generally stored on the floor of a room just above the top of the chemical feeder hoppers.

(1) Bags may be piled in layers but the total so stacked should not exceed the safe load limit of the floor.

. . . Stacked bags should be interlocked for safety.

. . . Handling procedures and storage practices are set forth in "A Consignee's Multiwall Bag Manual", which can be obtained from chemical suppliers.

. . . Precautions—Bags of aluminum sulfate and ferrous sulfate should not be stacked against bags of lime.

(2) Multiwall bags may be stacked on pallets for ease of handling. A forked lift truck can be used advantageously to move a number of bags from the storage area to the filling chutes of the chemical feeder hopper.

c. Liquids in bulk are stored in tanks of required capacity; the liquid is transferred to storage by air pressure or pump and may be transferred to chemical feeders in the same manner.

d. Liquefied gas in containers, such as chlorine and ammonia, requires floor storage space.

(1) Cylinders are stored upright; ton containers are cradled horizontally or placed horizontally on parallel rails.

(2) Indoor storage should be above ground and fire proof, as well as cool, dry, well ventilated and away from heat sources, walkways, elevators, stairways and ventilating system intakes.

(3) Stationary bulk storage of liquid chlorine is practiced where large quantities of chlorine are used.

. . . The pressure vessels normally are horizontal with dished heads fabricated in accordance with applicable code requirements of the city and state where located. Minimum standards are set forth in the ASME "Code for Unfired Pressure Vessels".

. . . The capacity of the tank is determined by the requirements of the treatment plant. Rail siding facilities are necessary near the storage tank for transfer from 30 ton tank cars to storage.

3. Weighing Chemicals

a. Water treatment plants should be provided with a means of weighing chemicals.

(1) Bulk chemicals received in carload lots should be weighed before and after unloading.

. . . Where received in trucks, the trucks are weighed before and after unloading.

(2) Packages or containers may be counted.

b. Where weights of chemicals fed are desired, several methods may be used: loss-in-weight feeders, feeders mounted on platform scales, platform scales at feeder loading point, transfer buckets mounted on trolley with trolley scales.

4. Transfer to Feeders

a. Dry Chemicals.

(1) In small plants, transfer of packaged chemicals to feeders or dissolving tanks is by hand trucks.

(2) In large plants using bulk storage, chemicals may be moved from the bins by gravity, or by bucket elevators or screw conveyor.

(3) Dust collectors should be used at chemical feeder loading chutes.

b. Liquids and Gases.

(1) Solutions may be moved by air pressure or by pump.

(2) Liquefied gas (chlorine) is moved to evaporator under its own vapor pressure.

E . . . Materials for Handling

1. Dry Chemicals

a. Iron, steel and concrete are commonly used for storage bins, platforms and hoppers.

b. Hygroscopic chemicals should be stored dry in tight containers.

2. Liquid Chemicals

a. Liquid alum is stored in lead, rubber lined, or Duriron tanks. Hard rubber or plastic pipe is used.

b. Sulfuric acid, concentrated, may be stored in iron or steel containers but dilute acid must be handled in lead, porcelain, glass or rubber containers and pipes.

c. Bromine and hydrofluoric acid, which are seldom used in water works, require special precautions.

3. Solutions

a. Neutral chemical solutions may be stored and handled in any of the common materials.

b. Acid chemical solutions are corrosive and must be stored and handled in materials not subject to corrosion.

(1) Metals and alloys used for this service include stainless steel, lead, Duriron, monel, nickel, hasteloy, haveg, etc.

. . . Not all of these metals are applicable to every solution and every use; before selecting a material a reference work should be consulted.

(2) Non-metallic materials include ceramics, glass, plastics, and rubber (hard and soft).

c. Alkaline solutions are generally not corrosive and usually may be handled in any material suitable for neutral solutions. Where incrustants are precipitated, rubber hose is suggested for conducting solution from feeder to point of discharge. (A single means of preventing incrustation of rubber hose feed lines is the subject of an article planned for an early issue of Water & Sewage Works.—Ed.)

4. Gases

a. Ammonia (liquefied and gaseous) may be handled in iron, steel, glass, nickel and monel.

b. Carbon dioxide, dry, is handled in iron and steel, but wet, must be handled in rubber, ceramics or glass.

c. Chlorine.

(1) Dry liquid or gas may be handled in black iron, copper or steel.

(2) Wet gas can be handled only in glass, silver, hard rubber, tantalum and certain plastics.

d. Sulfur dioxide.

(1) Dry liquid or gas, in steel.

(2) Wet gas, in glass rubber or ceramics.

F . . . Safety

1. Nontoxic Chemicals

a. Dry chemicals which have no toxic effect on humans present few problems of safety.

b. Normal care should be exercised to prevent physical injury due to improper handling of packages and unloading equipment.

2. Toxic Chemicals

a. Special precautions are necessary in the handling of chemicals which are toxic to human beings.

b. Dry, dusty materials should be handled with a minimum of dusting and the operator should be provided with a respirator to prevent inhalation of dust. Fluoride compounds copper sulfate, lime, etc. are included in this class.

c. Chlorine, ammonia, and sulfur dioxide require special care to prevent escape to the atmosphere. Gas masks are required equipment where these chemicals are used and the masks should be placed just outside the room where the feeding equipment is used.

3. Corrosive Chemicals

a. Liquids and solutions of corrosive nature usually should not be allowed to come into contact with the eyes, skin or clothing. Where used, adequate washing facilities should be available nearby.

b. Strong alkalies are considered corrosive to the skin, eyes and mucuous membranes; mildly alkaline substances usually have no effect on the skin but may hurt the eyes.

4. Other Hazards

a. Activated carbon is a fire hazard and in dust form in the atmosphere may be explosive. Dust control is necessary.

b. Quicklime will heat on slaking and may create a fire hazard.

c. Mixtures of ferrous sulfate, or aluminum sulfate and lime will heat and may cause fires.

d. Ozone and chlorine dioxide may be explosive in certain concentrations and concentrated sulfuric acid on wood may cause a fire.

References

Material in this lecture was based on B-I-F Industries Keep Sheet No. 22 which presents data on 52 chemicals used in water, sewage and waste treatment. Information is presented in this reference, on shipping data, characteristics and feeding recommendations. Other references works covering this general topic include: "Water Quality and Treatment—2nd Ed." published by the Am. Water Wks. Assn. and "Water Supply Engineering, 4th Ed." by Babbitt and Doland.

Next Lecture: Chemical Handling and Feeding—Part 2.

W&SW

CORRECTION

(Ref. page 64—February 1955)

Thos. F. Wolfe, Man. Dir., Cast Iron Pipe Research Assn., Chicago, Ill., has called attention to an error in the 19th lecture in this series. In "The Distribution System—Design and Construction," on p. 64 of the Feb. 1955 issue, Section 3b(4) lists the values of "C" for different pipe materials. This listing should read as follows:

Pipe Material	*"C" Value*
Asbestos-cement	140
Cast Iron (new)	140
Bitumastic enamel, centrifugally applied	150
Cement lined—centrif. method (actual diam.)	150
Pit cast, tar dipped	140
Cast Iron—old—(20 years)	
Tar dipped—inactive water	130
Bitumastic enamel—inactive water	135
Cement lined	140
Tuberculated	100*
Concrete—(best workmanship)	150
Concrete—(poor workmanship)	90
Wood Stave—(smooth)	120
Vitrified	110

* Or less, depending upon degree of tuberculation.

Returned for "Seed"

The governor of Colorado recently received what he considered a very unusual and priceless gift—a gallon of Colorado River water stolen from the California desert by a longtime friend.

According to a news report, the friend, a Denverite, said in a letter to the governor that he couldn't resist stealing the water as it flowed by his desert home in La Quinta, Calif., where he had been residing this winter and ". . . returning it to its rightful owners, the people of Colorado."

Worry kills energy, purpose, vitality—and produces *nothing*, but more worry.

Measuring Flow in Sewers by The Ohmmeter Technique

by JOHN D. EYE

Mr. Eye is Assistant Professor of Sanitary Engineering, Virginia Polytechnic Institute, Blacksburg, Va. His present article describes a unique method of measuring the flow in sewers, which the author developed and used extensively for carrying out a waste survey in a large industrial plant. Engineers concerned with sewage and waste flow measurement will find this method of interest.

KNOWLEDGE of the quantity of sewage or industrial waste being carried by sewers is essential in planning and designing treatment facilities, in planning sewer extensions, and in evaluating waste loads being introduced into receiving bodies of water.

The flow in sewers is generally estimated by: (1) direct discharge measurements; or (2) depth-velocity techniques. In general, the direct discharge methods are more accurate than the depth-velocity methods but usually are somewhat more limited in application. The ohmmeter technique falls within the classification of a depth-velocity method. In the author's experience, this technique has given excellent results and has proven to be extremely versatile.

Method and Techniques

The ohmmeter technique depends on the establishment of a depth-velocity-discharge relationship for the sewer to be gaged, and on the subsequent computation of the hydraulic elements used in an empirical formula such as Manning's. The elements entering Manning's formula for flow are: (1) the slope of the hydraulic gradient; (2) the hydraulic radius; and (3) the roughness coefficient.

The mean velocity of flow is measured either by a current meter or a pitot tube, and the corresponding depth of flow is determined by use of the depth gage described in this article. If the slope of the hydraulic gradient is known or assumed, the roughness coefficient can be computed from the above measurements; if the slope is unknown, a value of the roughness coefficient can be assumed and the slope computed for the flow existing at the instant the measurements were made. Inasmuch as channel conditions may cause a change in the computed slope with varying depths of flow, it is necessary to extend the measurements and computations over the range of flows normally expected.

After the slope and the roughness coefficient have been determined, a curve is plotted of depth vs. discharge. A hydraulic elements chart facilitates the plotting of this curve. Subsequent gagings require only the measurement of the depth of flow. This depth when referred to the discharge curve gives the flow through the section.

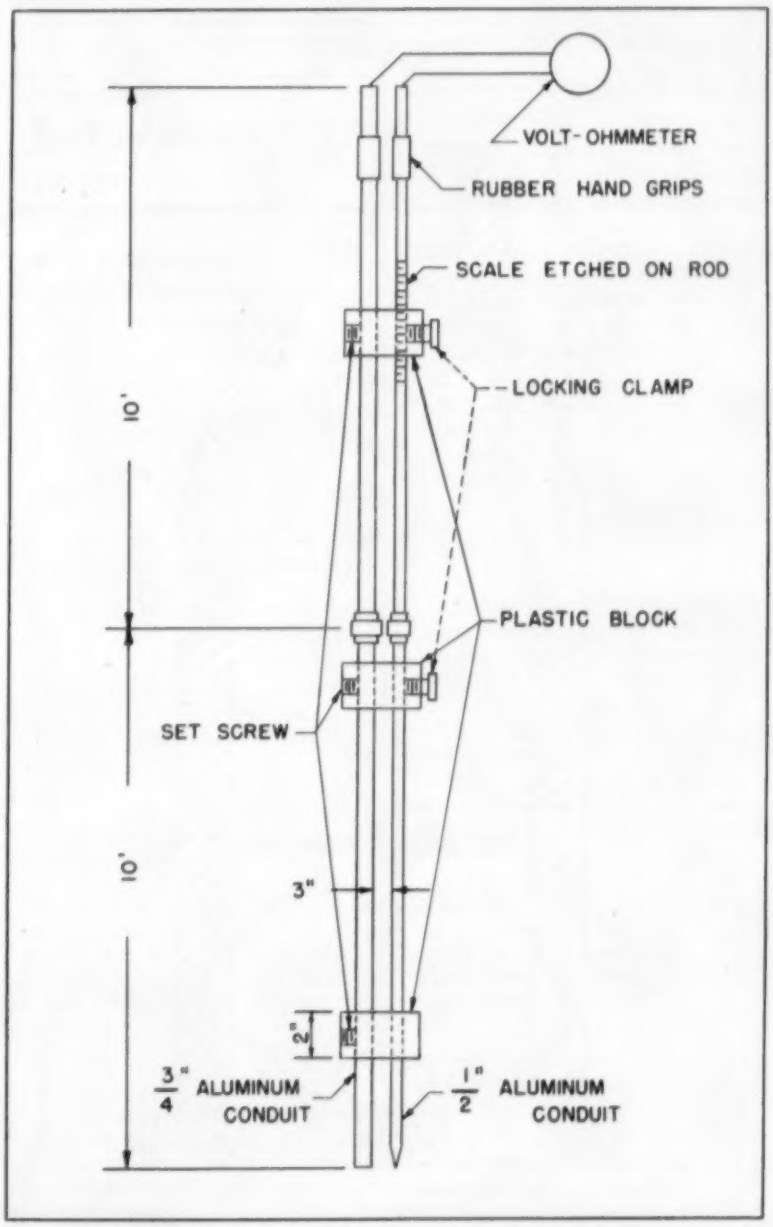


Fig. 1—OHMMETER depth gage, portable type, for flow measurement

Ohmmeter Depth Gage

A depth gage consists of two conductors insulated from each other—one movable with respect to the other—and an ohmmeter for impressing a voltage across the conductors, illustrated in Fig. 1. The depth of flow is determined by lowering the gage into the manhole until the fixed conductor rests on the invert of the sewer, then raising and lowering the movable conductor until it just makes contact with the liquid surface. The point of contact is determined by a deflection of the ohmmeter needle, which is caused by a completed circuit, when both conductors are in contact with the liquid. The depth of flow is read directly on a scale mounted or etched on the movable leg of the gage.

Depth gages are made of several types of materials, the ultimate choice depending on the operating conditions. If gagings are to be made at several widely separated manholes, a portable gage constructed from aluminum electrical conduits is most satisfactory.

When many readings are to be made at a single manhole, (especially if the sewer is large and the velocity of flow is high) a gage constructed of galvanized pipe and mounted directly in the manhole is more convenient to use than a portable gage, as in Fig. 2. When using a permanent setup, the depth is read on the staff gage mounted between the two sections of pipe.

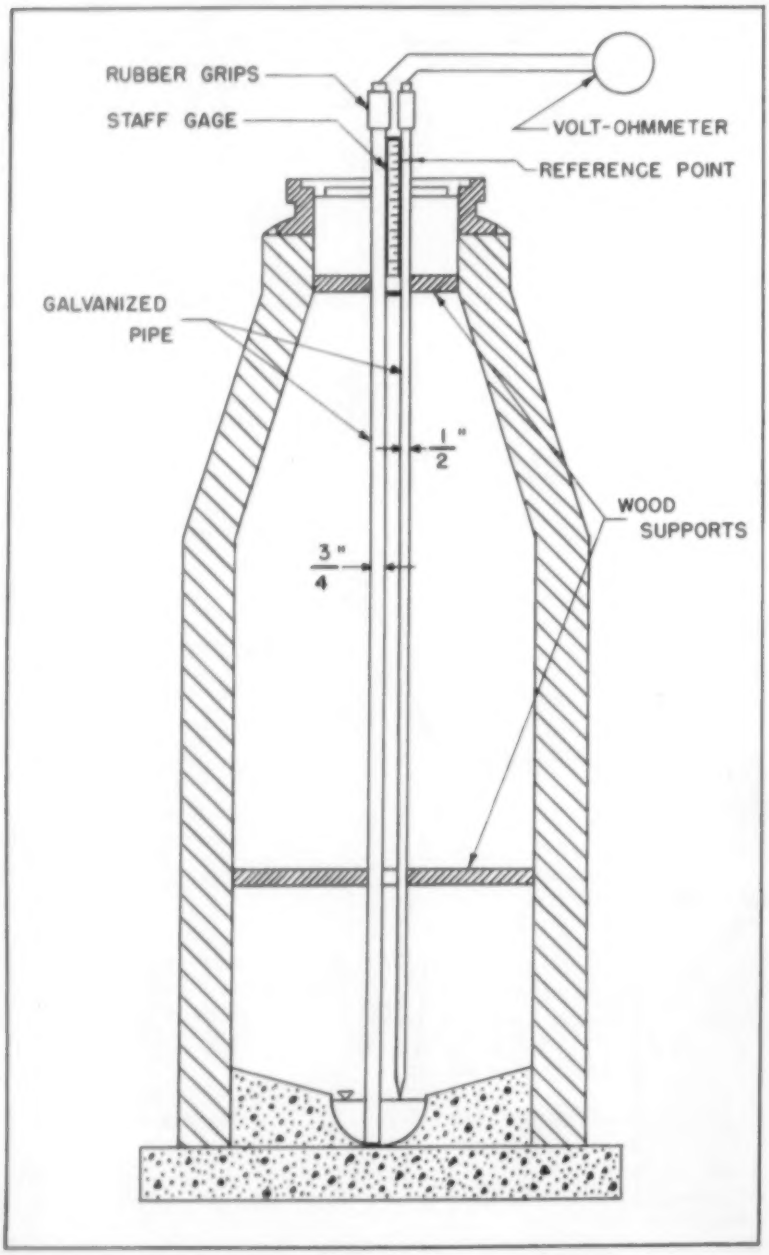


Fig. 2—PERMANENT installation of ohmmeter depth gage in manhole

Accuracy of the Method

The accuracy of the method depends primarily on the conditions under which the measurements are made and the care with which the measuring devices are manipulated. In a study at an industrial plant, covering twelve 24-hour periods, the waste discharged from the plant as determined by the ohmmeter technique was compared with the water pumped into the plant (corrected for losses). An average error of ± 5 per cent was observed. The maximum error for a 24-hour period was less than 10 per cent.

Limitations of the Technique

The use of the ohmmeter technique is limited to channel conditions which permit the hydraulic radius to be computed from the depth measurement. Non-junction manholes with a flow channel of the same shape and size as that of the approach sewer will generally meet the aforementioned qualification.

Velocities above about 10 feet per second cause splashing which affects the accuracy of the depth measurement. This interference can be minimized by reducing the sensitivity of the ohmmeter or by shielding the movable conductor.

The depth of the manhole is also a limiting factor because gages more than 20 feet in length are difficult to manipulate.

Other Applications of Depth Gage

The ohmmeter depth gage is well adapted to the measurement of the head on a weir. The gage is installed with the bottom of the conductors at the same elevation as the weir crest, and the staff gage is zeroed for this condition. When the movable conductor is raised until it contacts the water surface, the ohmmeter needle deflects and the depth or head reading is made directly on the staff gage. The locking clamp attached to the insulator makes it possible to obtain a more precise depth reading.

Summary

In the ohmmeter technique for sewer gaging, the depth and velocity are obtained simultaneously at a spe-

cific location. From these measurements, the elements used in an empirical formula such as Manning's are computed and the results plotted as discharge vs. depth. Subsequent gagings require only the depth measurement.

Conclusions

1. The ohmmeter method requires a minimum of equipment and field work.
2. The method is relatively accurate, giving errors of less than 10 per cent in the study outlined.
3. The method is versatile, because the required equipment can be made portable or installed permanently in a manhole.
4. The ohmmeter technique is applicable only when: (1) the hydraulic radius can be computed from the depth measurement; (2) the velocity is less than 10 feet per second; and (3) the depth of the manhole is 20 feet or less.
5. The depth gage is suitable for measuring the head on weirs.

How to Tell When It's Going to Rain

Also, When It's Going to Stop

If it rains on the first day of the month, it will rain 15 days or more that month. Check this for yourself on your calendars.

If it is raining, and you see air bubbles on the pools, it will rain some more that day.

When there is lightning and thunder in the winter time, Jan., Feb., up to March 21st, it will frost 90 days from that day. That's in the Northern states. Mark your calendar and check on this.

If it frosts in the 1st or 2nd quarter of the moon it does not do much damage to the crops. But if the frost is in the 3rd or 4th quarters it will be a killer more likely than not. Works same in fall or spring.

Here is another good sign that I have never seen fail. Six months from the date of the first thundershower in the spring you will have the first fall frost. I have never known it to vary more than a day or two. Check this on your calendar.

When animals huddle together in open fields, expect falling weather soon.

When fishworms appear in large numbers on the surface of the ground, get your umbrella.

When your corn or rheumatic joints are more painful than usual, anticipate rain.

Loud and continued cawing by crows is an indication of rain. Also a crow flying alone warns of rain, and bad weather.

When curly hair becomes more unruly than usual, rain is not far distant.

Dandelions always close their blossoms before a rain. An east wind is an almost certain sign of rain within 36 hours. If glow worms shine much, a rain is about to fall. When sea gulls fly inland, rain or bad weather may be expected. Many flies trying to get into the house are sure sign of rain, also flies bite harder and oftener than usual just before a rain.

When the temperature rises instead of falls at night, it will probably rain by morning.

If you have a wren house, you can tell whether or not it is going to rain by whether the birds stay in or out.

When circus men find their tent ropes growing tighter, they know that rain will fall shortly.

If crows fly in pairs expect fine weather.

Rain before seven, stops before eleven.

If the sun goes down cloudy Friday, sure of a clear Sunday.

Sunshine and showers, at the same time, rain again tomorrow.

When the wind is in the east, it's neither good for man or beast.

Red sky at night, is the "shepherds delight." Red sky at morning, the "shepherds take warning"—a saying as old as man, and holds true more often than not.

Three days' rain will empty any sky.

(Courtesy: *Pastime Gardening*)

Pickups from Purdue's "Sanitary Engineering News"

Don E. Bloodgood, Editor

The Chicago Southwest Sewage Treatment Plant has a capacity of 400 to 500 tons of dried sludge daily for sale as a commercial fertilizer base.

* * *

Opposition to fluoridation brings to mind that many other great advances in public health have met with similar opposition. Louis Pasteur's great work was ridiculed for years. (Also, chlorination had rough going in its early history 45 years ago.—Ed.)

* * *

Prof: What do you know about nitrates?

Student: Well, they're higher than day rates.

* * *

"It is much more important to be human than to be important."—Will Rogers.

* * *

The city of Adrian, Michigan, has been accused of contempt of court because they have not controlled the discharge of cyanide and chromium wastes. (This is what can happen to municipalities accepting industrial wastes in the city sewers.—Ed.)

* * *

A method is available for the estimation of fluoride in natural waters by titration with thorium nitrate using sodium alizarin sulphonate as indicator. The possibility of interference by sulphate, phosphate, carbonate, and bicarbonate ions is eliminated by preliminary treatment of the sample with barium chloride. The titration is carried out at a pH value of 3.3 in the presence of acetic acid.

* * *

Danville, Pa., has a sewer service charge of 100% of the water bill, a $12 per year minimum and a 0.10% increase for each ppm. of suspended solids in excess of 250 ppm. plus 0.5% for each ppm. of chlorine demand in excess of 15 ppm.

* * *

All but one of Michigan's seven sugar beet plants met Water Resources Commission requirements in their 1953-54 seasonal campaign.

* * *

There are three basic reasons for loss of lakes—addition of soil from eroded lands, cutting down of lake outlet by erosion, and addition of organic material from decomposed plant life.

* * *

An initial study of Texas reservoirs revealed that the "greatest single factor in production of algae blooms was available soluble phosphate content in water."

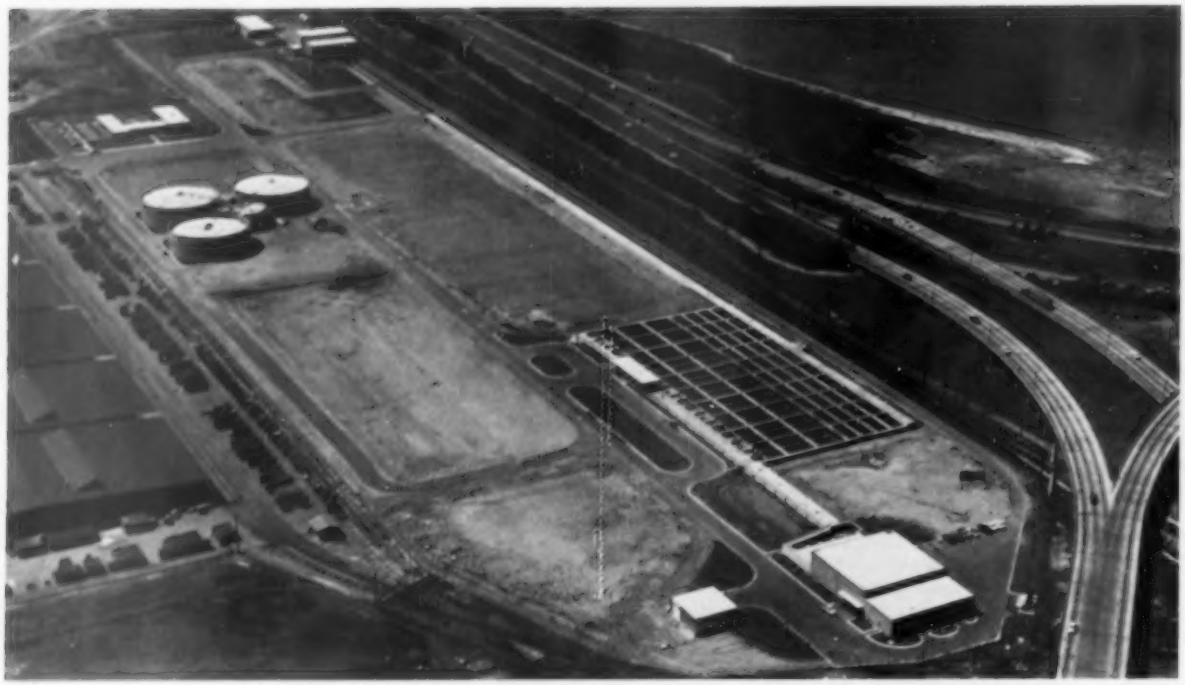
* * *

Recommendation: Use the term *service charge* instead of *sewer rental.*

* * *

It's been said many times that soft water is cheaper than dirt.

W&SW



SELECTIVE storm flow by-passing eliminates silt trouble at EBMUD plant

Storm Water Flow Selection Method Eliminates Silt Problems

by GERSON CHANIN

Mr. Chanin is Chief Sanitary Chemist at the East Bay Municipal Utility District's new $23,500,000 sewage treatment plant serving Alameda, Albany, Berkeley, Emeryville, Oakland and Piedmont, California. He presents a scientific approach to the by-passing of sewage diluted with storm water.

WHEN plans were being prepared for the $23,500,000 sewage treatment plant located in Oakland, California, now being operated by the East Bay Municipal Utility District, assurances were obtained from the six cities comprising the District that there would be complete separation of storm and sanitary sewers. Accordingly, all structures built below ground surface and which could not be readily added to or increased in capacity, were designed large enough to handle the sanitary and industrial sewage flow plus reasonable infiltration estimated for the year 2000; that is, a maximum flow of 291 mgd. Other structures were designed on the basis of the estimated maximum flows in the year 1970, or 238 mgd. No allowances were made for direct storm water runoff into the sanitary sewers, because none was to be received.

It was realized that some of the combined sewers serving large areas of at least one of the member cities would not be separated for quite a long time. These sewers were allowed to be connected to the East Bay Municipal Utility District's interceptors by way of diversion structures that direct all of the dry weather flow into the interceptor and divert storm water diluted sewage into the original outfall sewers which discharged into San Francisco Bay waters. These diversion structures, during rainstorms, permit a flow equal in volume to the dry weather flow to discharge into the intercepting sewer; or a gate may be shut to by-pass all or any part of the storm water flow to the outfall sewer.

Shortly after the treatment plant began operations it became evident that even though the diversion structures were closed so that none of the sewage flowed into the intercepting sewer, abnormally large volumes of storm water reached the treatment plant during rains by way of the sanitary sewers over which there was no control. It has been estimated that:

". . . flows accompanying a rainstorm of moderate intensity are over four times the normal sewage flow and for a rainstorm of long duration or unusual intensity such flows are

ACCUMULATION of sand in sedimentation basins stopped sludge collection mechanism and had to be removed manually

five times the maximum dry weather flow . . ."*

The handling of large volumes of storm water posed many problems in operation, one of the most important being the large amounts of fine sand and silt (particles with diameters of less than 0.2 mm) carried in surface runoff waters and not removed by settling in grit chambers, which generally are designed to remove particles greater than 0.2 mm in diameter. Fine sand and silt, therefore, collected in the sedimentation basins and during storms was of great enough quantity to completely cover the sludge collectors, thus stopping the mechanism.

In addition, pumping of sand-laden sludge wore out sludge pump impellers and shear bars. Sand-laden sludge could not be put into the digesters and was by-passed. After every storm it was necessary to dewater the sedimentation basins and to remove the sand manually. Particle size analysis of this sand accumulation revealed that a large part of the accumulated material was fine sand and silt with diameters less than 0.2 mm (Table 1).

To eliminate these difficulties a channel was constructed at a cost of $30,000 to by-pass storm waters around the sedimentation basins. This report primarily concerns itself with the operation of this by-pass channel; that is, when to open and when to close the by-pass gates.

By-passing of storm water diluted sewage into receiving waters for the comparatively few rainy days during the year is not particularly objectionable, because the by-passed diluted sewage is much weaker than the ordinary dry weather raw sewage and is also weaker than the effluent generally discharged from a primary treatment plant. Table 2 illustrates this point.

It is only in settleable solids that the rainwater diluted sewage exceeds the normal plant effluent in strength. However, during rains the settleable

*"Rainwater Runoff in Sanitary Sewers," Report by East Bay Municipal Utility District, Special District No. 1, February 10, 1954.

TABLE 1

Particle Size Range of Sand Accumulation

Percent of Sample	Particle Size (Diameter) Millimeters	Description
8.0	0.84 or larger	Coarse sand and gravel
0.8	0.59 to 0.84	Coarse sand
3.6	0.42 to 0.59	Medium sand
30.6	0.21 to 0.42	Fine sand
57.0	0.21 or smaller	Fine sand and silt

TABLE 2

Average Characteristics of Sewage Flows

Flow	B.O.D., Parts per Million	Susp. Sol., Parts per Million	Settl. Sol., Ml. per Liter per Hr.
Raw sewage, entire year	324	274	10.5
Raw sewage, rainwater diluted	82	64	4.9
Plant effluent, entire year	251	167	1.3

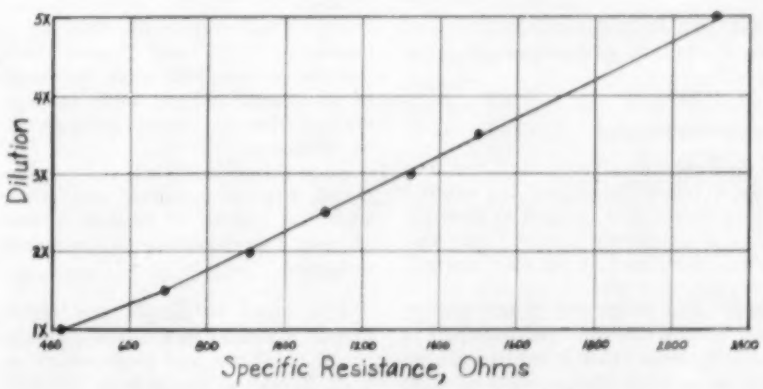


Fig. 1—VARIATION of specific resistance with dilution

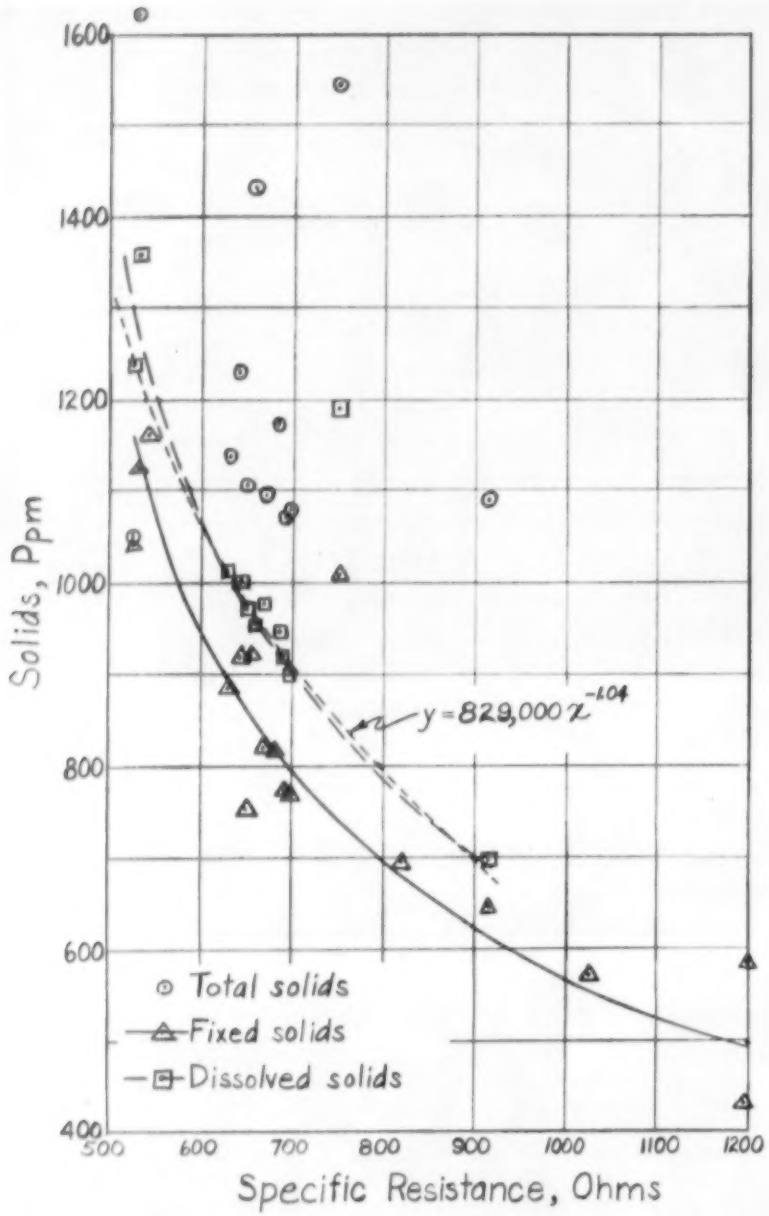


Fig. 2—VARIATION of specific resistance with total, fixed, and dissolved solids.

solids are largely sand particles, so this increase in settleable solids is not objectionable.

Rapid Test Needed

Because one or two pumps had been used to pump the normal dry weather flows, it was first decided to open the by-pass gates when more than two pumps were used. It was soon learned, however, that after a rainfall appreciable sand is carried in the sewage flow even when only two pumps are used. Inasmuch as it is not practical to test sewage for the presence of sand and silt, some characteristic of the sewage which reflects the presence or absence of storm water dilution would have to be measured as an indication of when sand and silt might be present and when the by-pass gates should be opened.

Such things as solids, chlorine demand, relative stability, and others were the first to be treated without success. The requirements for a good test are:

1. It must be simple and rapid; that is, it should be a test anyone can readily perform and from which results should be available in a matter of minutes.
2. It must measure an effect of rainwater dilution upon the sewage.
3. The effect or constituent measured must have a value that is not generally found during dry weather flows.

Test Method

Use of a conductivity meter or resistance bridge* which would roughly measure the dissolved inorganic solids seemed to offer a simple way of accomplishing this. As these solids are diluted by storm water the electrical resistance of the resulting solution will increase. The value of the resistance of the raw sewage is, of course, subject to rather wide variations and it was first necessary to establish this variation for the dry weather sewage flows at the time of the rainy season.

Hundreds of tests showed a specific resistance (not corrected for temperature) varying from 425 ohms to 1,200 ohms, with an average value of 800 ohms. This is equivalent to a conductance of about 1,250 micromhos. Since these tests were performed on dry days during the rainy season, the resistances may be somewhat higher than those which would be obtained during the dry season because of decreased infiltration at that time.

The resistances as read from the bridge circuit were corrected for the geometry of the cell, but not for changes in temperature. Temperature corrections were not made because the temperatures remained relatively constant and for this study all that was necessary was to detect differences in electrical resistances rather than to determine the actual specific resistances at 18°C, as is usually done.

Tests were run by diluting sewage with distilled water to demonstrate the effects of dilution on the resistance of raw sewage. The results are shown in Fig. 1. An almost linear effect was demonstrated.

A series of tests was run to relate the total, dissolved, and fixed solids to the resistance. These results are shown in Fig. 2. As might be expected, there is better correlation between the dissolved solids and the measured resistance than between the total solids and the resistance, since inorganic salts make up a large part of the dissolved solids. The relationship found in the case of dissolved solids was not a linear one.

Test Results

A fairly good correlation was ob-

*The RC-7 conductivity meter, manufactured by Industrial Instrument Company, was used in these studies.

tained between the total fixed solids and the resistance. The fixed solids are those inorganic solids which remain after a sample of sewage has been dried and ignited at 600°C. Since insoluble inorganics such as sand and silt will increase the fixed solids without affecting the resistance, one might expect the variation found, especially during the wet season.

Figure 2 substantiates the original premise that dilution will result in lowered solids content and increased resistances.

From the daily variation in the resistance for dry days during the rainy season it would appear that there is a peak resistance between 7:00 and 11:00 p.m. At no time did the resistance go above 1,200 ohms.

Based on dilution tests and field resistance measurements of both dry and wet weather flows, the value of the resistance above which the by-pass gates would be opened was set at 1,350 ohms. This represents about a two-fold dilution of the sewage.

In practice, if two consecutive readings of 1,350 or more ohms were obtained at 5-minute intervals sometime after a rain began, the by-pass gates were opened. After the rain stopped and after two consecutive readings of less than 1,350 ohms were obtained, the by-pass gates were closed.

This method of operation was followed during the April 1954 rain storms with complete success. Treatment plant operators and chemists performed the necessary resistance measurements. Operating experience confirmed the fact that only very small amounts of fine sand and silt collected in the sedimentation basins when this procedure was followed.

Several observations may be made from plottings of the variations in sewage flow and resistance and the hourly accumulated rainfall over both wet and dry days in April 1954, as follows:

1. The measured resistance during dry weather never went above 1,350 ohms, the value chosen to represent sufficient rainwater dilution to open the by-pass.
2. Resistances above 1,350 ohms were found only after rainfalls.
3. In general, the resistance varied with the pumping rate, the highest resistances being found at high pumping rates.
4. Although the rate of storm water flow is controlled by the intensity of the rainfall, in general, storm water flows reached the treatment plant within 1 to 2 hours after a rain began, and tapered off in 3 to 5 hours after the rain stopped.

A theoretical exponential curve of the equation

$$y = 829{,}000\ x^{-1.04}$$

was found to fit the experimental data fairly well. This curve is shown as the dotted line in Figure 2. This equation is more usable in its logarithmic form:

$$\log y = 5.9188 - 1.04 \log x$$

An example of the way in which this equation could be employed to determine the resistance value at which the by-pass should be opened is as follows:

Assume that the dry weather dissolved solids in the sewage at a particular time of the year is about 1,000 ppm. If it is assumed that it is desired to by-pass when the sewage is diluted two-fold, then by-passing should begin when the dissolved solids content is 500 ppm. Solving for x when $y = 500$ gives $x = 1{,}250$ ohms = the resistance value indicating two-fold dilution.

The resistance value above which one by-passes will differ from time to time as the dissolved solids concentrations in the raw sewage vary. In general, the dissolved solids concentrations will increase as the sewage strength increases. Sewage strength, as indicated by the average monthly B.O.D.'s and dissolved solids concentrations for the year 1954 at the East Bay Municipal Utility District's sewage treatment plant, is given in Table 3.

TABLE 3

Average Monthly B.O.D. and Dissolved Solids Concentrations, 1954

Month	Dissolved Solids, PPM	5-Day B.O.D., PPM
January	1,610	284
February	1,760	285
March	987	244
April	811	283
May	1,084	285
June	2,268	324
July	2,046	375
August	2,386	527
September	1,778	543
October	1,530	456
November	1,637	372
December	949	319

It is evident that, at this plant, the nature of the raw sewage varies greatly from month to month; from the relatively weak sewages during the rainy season of December, January, February, and March to the relatively strong sewages during the fruit and vegetable canning season of August, September and October.

Because of these variations the by-pass resistance value must be recalculated at frequent intervals, taking the actual composition of the raw sewage into account. If the dissolved solids contents remained more or less constant during the year, one calculation would suffice for the entire year. Therefore, in applying this method for determining when to by-pass each operator will have to make his own evaluation of the problem as it applies to the conditions at his plant.

Summary

One phase of the handling of storm water flows at the sewage treatment plant has been discussed at some length; namely, the determination of when to by-pass such flows. Although the material presented relates only to the conditions at one particular treatment plant, similar studies can be made at other plants to obtain similar conclusions.

The actual value of the electrical resistance above which there is sufficient dilution and, consequently, sufficient sand present to necessitate by-passing of the raw sewage will, of course, vary from place to place. But once established this value should hold for some time.

The original assumption, that when sewage is sufficiently diluted with surface runoff water significant quantities of fine sand and silt will be present, seems to have been substantiated by actual operating experiences.

Acknowledgments

The author wishes to express his thanks to all the members of the Sanitary Section and the Operations Section of the East Bay Municipal Utility District's sewage treatment plant, who, under the supervision of E. H. Chow, Senior Sanitary Chemist, and E. L. Macdonald, Jr., Pumping Plant Foreman, performed the many tests and measurements required for this study.

It seems incredible but it has been estimated that between 30-40 per cent of the annual U. S. steel output goes to replace corrosion losses.

Arctic Sewer and Soil Temperatures

How Fairbanks, Alaska, Is Deicing Its Sewers

by WILLIAM B. PAGE

Mr. Page is Chief of the Environmental Sanitation Section of the U. S. Public Health Service's Arctic Health Research Center, Anchorage, Alaska. His article describes the investigations and construction being carried on at Fairbanks to solve the critical problem of sewer system freeze-ups in extremely cold weather.

IN MOST of the United States, the temperature of the sewer in relation to that of the soil surrounding it is not considered of great importance. At Fairbanks, Alaska, however, soil temperature has been found to be one of the most important factors affecting the functioning of the sewers.

Severe Climatic Conditions

Fairbanks is located in the interior region of Alaska, in the Tanana River Valley, at a geographical position of 64°50′ North latitude and 147°43′ West longitude, which places it well within the permafrost zone and subjects it to all the temperature extremes typical of the interior subarctic regions. Summer temperatures get as high as 90° F. and winter temperatures often drop to 55° F. below zero.

Freezing weather commences in September and snow is usually present by October. In December the sun rises at about 10:00 a.m. and sets at 2:00 p.m. This short interval of sunlight means that during the cold waves, which last from one to three weeks, little rise in temperature occurs during the day; the average temperature for the entire 24 hours may be minus 45° F. This results in deep seasonal frost penetration, especially during winters when snowfall is light.

In addition to the problem of deep seasonal frost, much of the Fairbanks area contains permanently frozen ground starting at three to four feet below the surface and extending downward to depths of 100 feet. The problem of installing and operating a sewer system in such a locality differs from the usual condition in the United States.

Existing Sewer System

The present sewer system at Fairbanks was originally constructed in 1938-39. Lack of funds necessitated a design with two instead of three lift pumping stations, with a consequent decrease in grades and cover, and an unusual number of dead ends. The outfall sewer discharges raw sewage into the Chena River downstream from the town. At flood stage the sewage must be lifted by pumps which are controlled by float switches installed in the outfall sewer upstream from the terminal pumping station.

The collection system is composed of wood stave pipe and has a history of maintenance trouble beginning with the first winter of its operation. The basic trouble was clogging or failure of the lines to pass sewage. The clogging was originally thought to be due to freezing.

This view was reinforced by the fact that flow would resume after steam was forced into the lines at manholes adjacent to the obstructed section. House lines commonly clogged and these were steamed out in similar fashion. Steam thawing became so common that steam pipes were inserted into the line between manholes permanently and brought up to the surface of the ground to facilitate the introduction of steam.

Rehabilitation Program

In August 1949, a four-year sewer rehabilitation program was undertaken under the direction of the City Engineer. This program was intended to relieve the city of a portion of its costly sewer maintenance bill, particularly in the winter months. The cost of rehabilitation was considered preferable to an annual winter maintenance cost of $16,031 in 1947-48 and $35,033 in 1948-49. Since the sewer system served about 8,000 people, the annual cost per capita was appreciable.

Rehabilitation varied from excavation and inspection to the replacement of sections of the old 6-inch sewer with a new 8-inch sewer line. Excavation of the system revealed that several of the lines were partially clogged with mud, rocks and debris. Some had open holes in the top and sides resulting from unauthorized private connections and thawing operations in the past.

In addition to clogged sections, the sewers in several instances had positive grades resulting from sags in the line, which could have been caused by the melting of the permafrost in the vicinity of the sewer. If permafrost has a high moisture content its load-bearing capacity is reduced drastically when thawed. This is a typical problem in areas where a clay, silt, or fine sand soil is present in a permafrost area.

Other System Defects

The main defects, outside of poor alignment of grade and clogging due to debris and street litter, appeared to be insufficient flow and lack of soil cover. The sewer system was laid out in the form of a fan, with the intercepting sewer running east and west through the city. It has been pointed out by the City Engineer that a system of lateral sewers running east and west and emptying directly into the river or into an interceptor sewer along the river bank would result in about one-tenth of the dead ends now in existence and a larger flow would exist in all the sewers. In the winter and spring months when the ground temperatures at the sewer level are below freezing the east-west lines could be flushed periodically with flush tanks at the dead ends.

The rate of flow is very important when the temperature of the soil adjacent to the sewer is below freezing. Many of the laterals are only one block in length and there are insufficient services per block to maintain a flow through the sewer at all times during the day. This condition results in a gradual accumulation of ice until flow is blocked completely by a solid ice plug.

Absence of a water system in much of Fairbanks results in a low con-

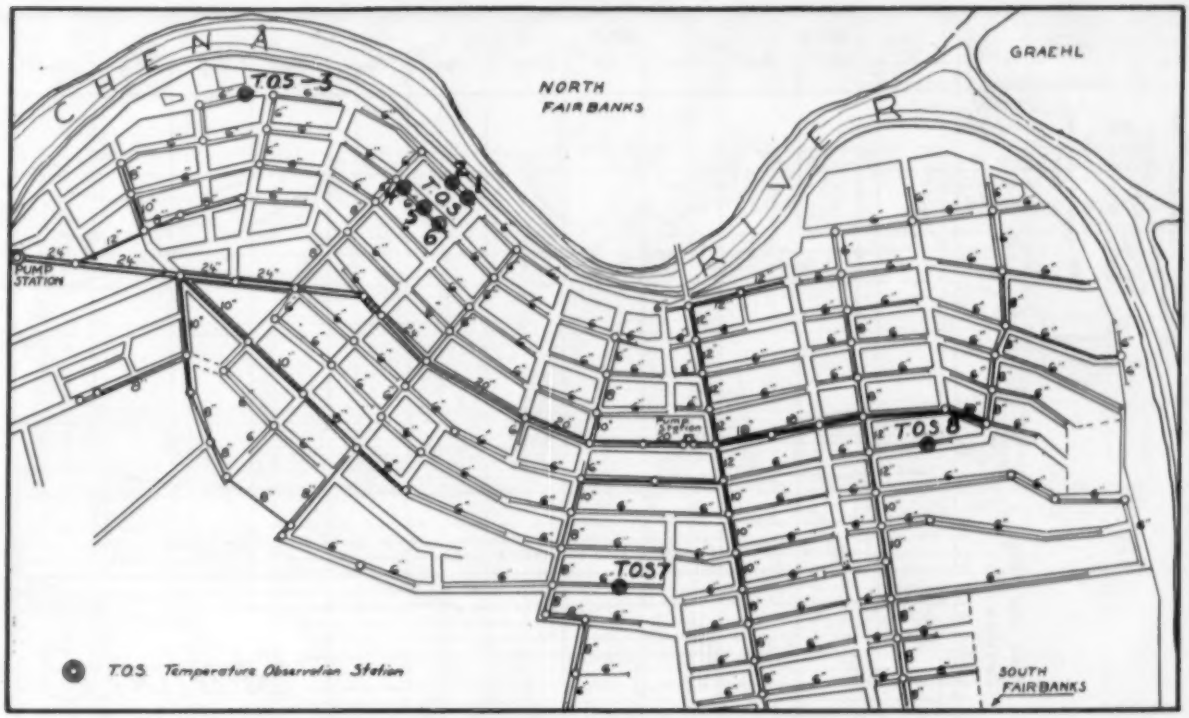


Fig. 1—LOCATION of thermocouple installations for Fairbanks sewer temperature observations

sumption per capita during the winter when the shallow-well water table is low. Thus, the least flow occurs at the time of year when maximum flow is needed to offset the danger of freezing.

Temperature Observations

Design and operation of municipal sewer systems in sub-arctic areas are dependent to a large extent on the knowledge of temperature and heat losses in the collection system and in the soil adjacent to the sewers. To secure factual information on this subject a program of temperature observation was undertaken in the fall of 1949 on the sewer system of Fairbanks. This information was also intended to aid the rehabilitation program.

The program involved cooperation between the engineering department of the City of Fairbanks, the Alaska Department of Health, the U. S. Engineers, and the Arctic Health Research Center of the U. S. Public Health Service.

Thermocouple Installation

Limited equipment and personnel restricted the work to thermocouple temperature measurement at eight sites in the city. Soil samples were taken as the ground was excavated for installation of the measuring couples. Selection of the temperature observation sites was made on the advice of the City Engineer, who was thoroughly familiar with the system and its maintenance troubles (See Fig. 1).

The greatest concentration of thermocouples was placed on First and Second Avenues in the 1000 block, with a total of 45 thermocouples installed along these two sewer lines. The line on First Avenue never froze, whereas the line on Second Avenue had a history of periodic freezing each winter and spring. It was considered likely that a comparison of temperatures in the two lines would explain the difference in functioning.

A 6-inch sewer on First Avenue in the 1200 and 1300 blocks had been replaced with an 8-inch sewer. A string of thermocouples was installed in the 1300 block in order to compare the temperature in the new 8-inch line with those of the 6-inch sewers in use, such as the sewer on Ninth Avenue. An installation on Ninth Avenue in the 600 block was thought to be a typical representative example of average conditions in the 6-inch sewer system.

On Sixth Avenue, two-thirds of a block east of Noble Street, the sewer was bedded on permafrost. A thermocouple installation was placed here to obtain direct readings on the existing temperature relationship. Ten thermocouples were installed in various locations at each temperature observation station (See Fig. 2).

Each installation was intended to provide temperature measurements at intervals of 1 foot, starting approximately 1 foot below ground surface and extending to 1 foot below the sewer invert. Thermocouples were placed at intervals of 6 to 12 inches for a distance of 2 feet horizontally from the sewer. Two thermocouples were placed within the sewer itself, one in the invert and the other in the air at the top of the sewer.

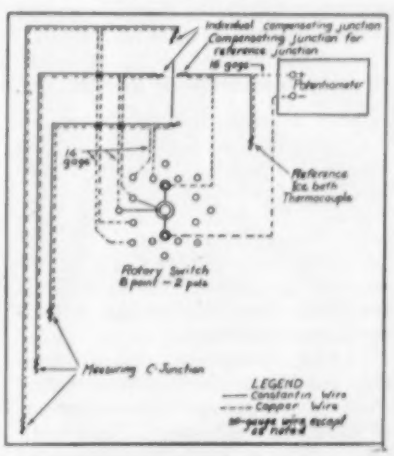


Fig. 2—THERMOCOUPLE circuit diagram for sewage temperature measurements

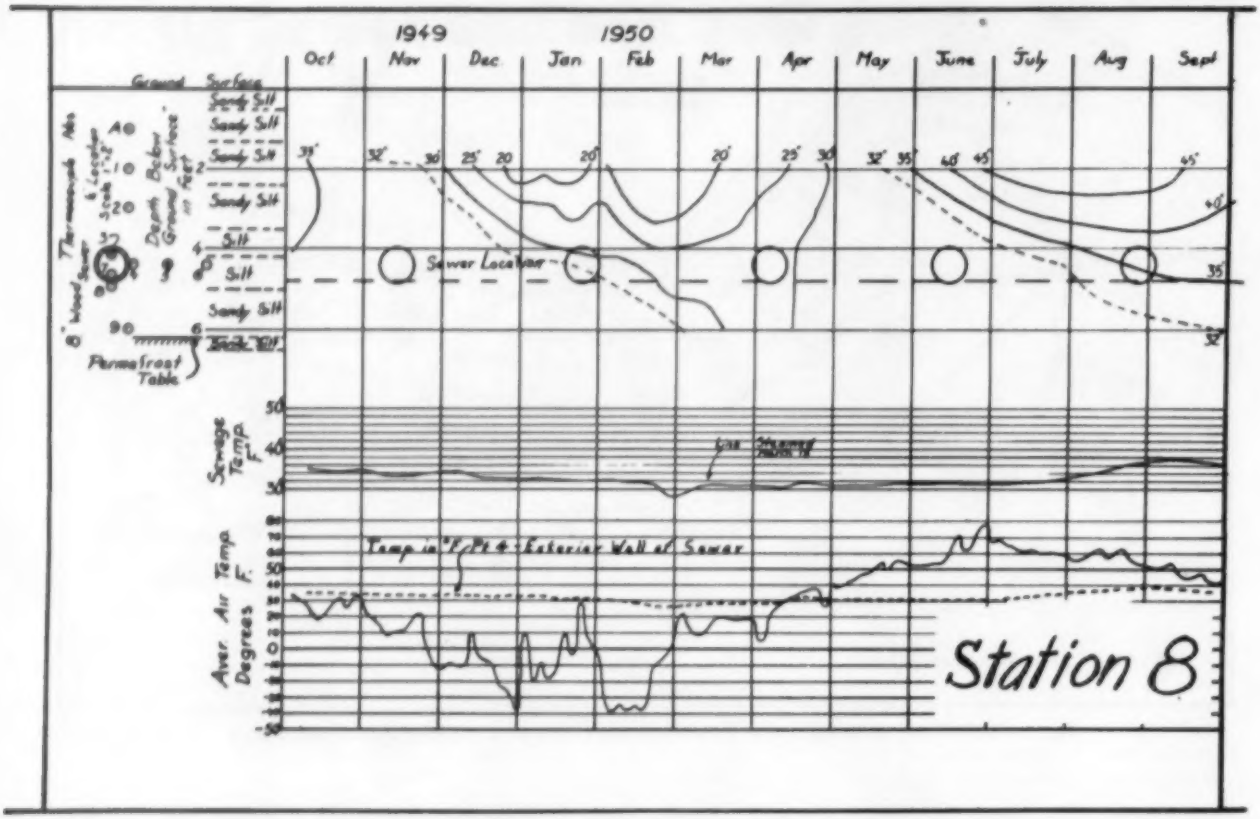


Fig. 3—TYPICAL record comparing air, sewage, sewer, and ground temperatures

Temperatures were read by potentiometer three times a week. The interval between readings was increased in May 1950, due to the pressure of other work, readings from that time on being scattered at intervals of two weeks and occasionally of one a month.

Graphical records were made for all the stations showing the relationship between air, sewage, sewer, and ground temperatures. Fig. 3 is typical of such records.

Interpretation of Results

From a comparison of the graphs it appears that, as a general rule, the sewage temperature follows a seasonal trend which is related to the seasonal change of the air temperature. Where earth cover is shallow the sewage temperature has a greater seasonal fluctuation. This variation is amplified when the sewage flow is small or intermittent.

Sudden changes in the air temperature do not effect a corresponding change in the sewage temperature until some time has passed. This interval of delay is the time required for the effect of the low temperatures to reach the soil around the sewer. A delay interval of one to three weeks is to be expected where the soil cover is 5 to 6 feet deep. This is evident in Figure 3 for the low temperature period which occurred in February 1950.

Effect of Earth Cover

The actual function of earth cover is to decrease the rate of heat loss upwards from the soil adjacent to the sewer. At the end of the winter cold period, heat still continues to flow from the warmer earth at sewer level upwards toward the colder earth near the ground surface.

This process continues even when the top layer of soil has been thawed by solar heat. Under this condition of thawed surface soil, heat flows downward from the ground surface to the soil immediately below and as long as this subsurface soil is cooler than that adjacent to the sewer, heat is also flowing upward from the sewer location. This results in a decrease in the temperature of the soil at sewer depth and explains the saying, "the spring thaw drives the frost down."

The ideal situation then, is to have enough earth cover to delay heat losses upward from the soil adjacent to the sewer prior to the penetration of spring and summer solar heat so that freezing never occurs at the depth of the sewer.

The Department of Building Research in Canada has been conducting research involving soil temperatures under streets and adjacent to sewer and water lines. It was noted in their observations that a 12-inch sewer supplied enough heat to raise the temperature of the surrounding soil above that of soil where no sewer was present. Studies of the effect of different types of soil cover indicated that clay soils are better insulators than sandy soils.

This conclusion is borne out by the observations in Fairbanks. There, sewers protected by a cover of gravel were exposed to lower temperatures than those protected by the same depth of silt or sandy silt soil cover.

Effect of Flow

The amount of sewage flowing through the sewers has a critical minimum value when the temperature of the soil around the sewer is at or below freezing. If a sufficient flow is maintained, enough heat can be supplied to the interior walls of the sewer

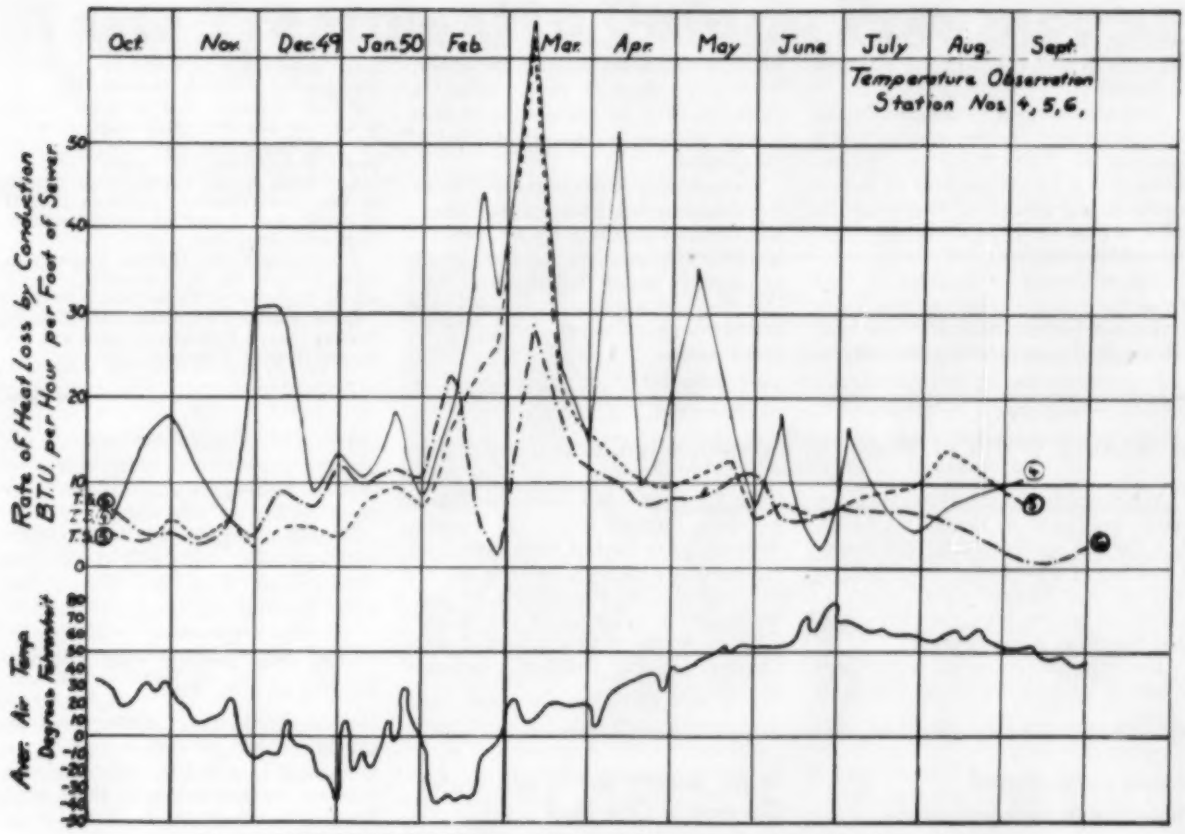


Fig. 4—RATE OF HEAT LOSS by conduction from a sewer under sub-arctic conditions

to prevent formation of ice, even though the temperature of the sewage is as low as 32° F. or slightly above.

It has been demonstrated at Fairbanks that a simple 100-gallon flush tank supplied with ground water at 33° F. not only will prevent the freezing of a sewer, but also will thaw a sewer filled to the longitudinal axis with ice. The amount of water used was approximately 500 gallons per hour. Further investigation should determine what the lower limit of flush tank discharge rate should be for a specified length of sewer surrounded by soil at a given temperature. The temperature observations made at Fairbanks were used to compute the rate of heat conduction from the sewer to the surrounding soil.

Rate of Heat Loss

Rate of heat loss per foot of sewer was computed for each of the temperature observation stations. These computations were based on temperatures observed and computed thermal conductivities of the soil surrounding the sewer at the time of thermocouple installation. The results are approximate, but a comparison of the computed heat loss rate with the heat available in 33° F. water indicates the value of cold-water flushing.

TABLE 1

Rate of Heat Loss by Conduction From Sewer at Temperature Observation Station No. 6

Date	BTU per Hour per Foot	Date	BTU per Hour per Foot
1949		1950	
10-10[a]	6.8	3-9	28.9
10-20	3.7	3-20	17.3
10-31	4.0	3-31	11.7
11-9	2.8	4-10	10.1
11-21	5.4	4-19	7.3
11-30	3.6	4-28	8.0
12-9[b]	9.0	5-8	8.1
12-21	6.9	5-19	10.5
12-30	12.0	5-31[a]	11.0
		6-9	5.6
1950			
1-9	9.9	6-23	6.1
1-20	11.5	7-3	6.8
1-30	10.5	7-28	6.5
2-10	22.4	8-7	5.6
2-21	5.0	9-5	0.6
2-27	1.4	9-29	2.3

[b]Ground frozen around sewer.

[a]Ground thawed around sewer.

Temperature Observation Station No. 6 is selected as an example. Table 1 indicates the rate of heat loss computed for the date indicated.

Selecting the values of heat loss rates for the three most severe winter months (January, February and March) an arithmetical mean rate of heat loss of 13.2 BTU per hour per foot of sewer pipe results (See Fig. 4). If the condition of heat loss at Station 6 (see Fig. 1) is assumed to be representative of the entire 400-foot length of lateral, then the total heat loss is 5,280 BTU per hour. This should be a conservative value, as the flow increases in the sewer toward its downstream end.

If a flush tank were installed at the dead end of this lateral and supplied with ground water at 33° F., an estimate of the flushing rate could be calculated as follows. Using the 1° temperature drop from 33° to 32° F., each gallon of water can provide 8.35 BTU if all of the heat transfers radially through the sewer walls. Then

630 gallons per hour would compensate for the heat loss of 5,280 BTU per hour which exists in the 400 feet of lateral.

This uses none of the heat of fusion still remaining in the water, which amounts to 1,200 BTU per gallon. Thus, if 5 BTU of the heat of fusion available per pound of water can be used, a flow of 105 gallons per hour should be sufficient.

The efficiency of transfer of heat from the flowing liquid to the sewer walls will be less than 100 per cent. This unknown factor can probably be best evaluated by observing the soil temperatures adjacent to the sewer for various known flows in the sewer. Such a problem is very similar to those involved in the design of heat pumps utilizing a pipe grid buried in the ground.

Considerable work has been done on evaluating heat transfer coefficients and thermal conductivity of soils related to the problem of heat pump systems. It seems that much of this knowledge is applicable to the design and operation of sewer systems in the arctic zones.

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A Nickel's Worth of Water in Indianapolis Clean-Up Parade

When the Indianapolis Water Company took part in the City's Clean-Up Parade, sponsored by the Junior Chamber of Commerce, the Company had no float entered—just a nickel's worth of water, plus the "fire plug" and his "dog, Little Squirt!"

Being unable to secure a sufficient number of employee's children in time to have each one carry two 1-gallon jugs of water, 14 coaster wagons were rented from Goodwill Industries and the children pulled the water. The wagonloads of jugs were visible evidence of the 90 gallons of water which a nickel purchases. Several thousand persons saw the parade.

Sluice Gates Permit Selective Drawing of Water

Billions of gallons of water which formerly flooded Dallas, Texas, will soon fill the Garza-Little Elm Reservoir, located 22 miles northwest of Dallas. It is one of four reservoirs which will provide flood protection, controlled water supply for irrigation in times of drought, water supply for towns and cities, and new recreational facilities.

The huge earthwork dam is 125 feet high and over 6 miles long, and will impound 170 billion gallons of water. Near the eastern end of the dam lies an uncontrolled spillway as a safety measure against floods even greater than any heretofore experienced. Near the middle of the dam is the outlet structure pictured. Essential to its functioning are the four Rodney Hunt cast iron bronze-mounted sluice gates which control the flow of water between the reservoir and the city of Dallas. The gates are located at various levels to permit selective drawing of water from different strata of the reservoir.

The gates are 60-in. by 84-in. in size and operate under heads of 25 ft. to 48 ft. They are of the rising stem type with side, top and bottom wedges to insure positive seating. The gates are controlled by floorstands with selective two-speed crank-operated hoists.

Water Supply and Waste Water Covered in One Book

A new book of 973 pages on the subject "Water Supply and Waste Water Disposal" has been prepared by Gordon M. Fair, Harvard University, and John C. Geyer, Johns Hopkins University, with a special chapter by John C. Morris, Harvard University.

The 30 chapters cover the elements of water sanitation and of hydrology; specific problems of water supply; the physical, chemical, and biological problems of water and wastes; and the various methods of water and waste water treatment.

This book is published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. The price is $15.00 per copy.

Water Conditioning For Industry Topic of New Book

A new book titled "Water Conditioning for Industry" has been prepared by Sheppard T. Powell, Consulting Engineer. This book is designed to answer many of the growing needs of industry for higher quality water, by discussing all useful water-conditioning methods.

Specific methods and types of equipment are described in detail. Problems of corrosion control, embrittlement of boiler steel, steam quality, and treatment of water for high pressure boilers are emphasized. Testing methods are also covered.

This book is published by McGraw-Hill Book Co., Inc., 330 West 42nd Street, New York 36, N. Y. The price is $9.00 per copy.

Water and Sewage Microbiology Subject of New Book

A new book titled "Water and Sewage Microbiology" is described by the publishers as a strictly practical book written for readers who have little training in chemistry or biology. In addition to a brief review of the fundamental properties of living organisms, it covers such problems as stream sanitation, biological methods of waste treatment, and soil pollution.

The authors are P. L. Gainey and Thomas H. Lord, Professors of Bacteriology, Kansas State Teachers College. This book is published by Prentice-Hall, Inc., 70 Fifth Avenue, New York 11, N. Y. Price is $5.90 per copy.

"I think its the sump-pump: All I can get out of George is GLUB-GLUB!"

Waste Treatment in Ontario Province

Expanding industry in the "Chemical Valley" of Canada necessitates study and treatment of wastes—particularly phenols

by A. V. DE LAPORTE

Mr. DeLaporte is Chemical-Engineer-in-Charge, Experimental Station, San. Eng. Div., Ontario Dept. of Health, Toronto, Canada. His paper covering the organization and operation of a cooperative international organization was presented at the Ninth Purdue Industrial Waste Conference.

THE PROVINCE of Ontario extends from Lake of the Woods to the Ottawa River, and from the Great Lakes to Hudson's Bay. Geographically and geologically it is divided roughly into two portions—Southern Ontario and Northern Ontario. Northern Ontario's pollution problems arise from the basic industries of paper making and mining and smelting. Southern Ontario has a more diversified industry, and the waste problems include canning, meat packing, milk processing, plating, metal working, chemical, textile—in fact, range over the whole gamut of industrial waste pollution.

Industrialization really started in Ontario during the 1914-1918 war, and the change from an agricultural to an industrial era was proceeding in an orderly way until 1939. The second war stimulated greater industrial expansion, and due to war-caused material and labor shortage, industrial waste treatment made no progress. With the cessation of hostilities, steps were required to overcome the backlog of work—and to insure that rapidly expanding industry took care of its wastes.

No successful method of treatment has yet been discovered for some of the wastes produced. It was recognized that to be successful any plan of waste treatment must have the whole-hearted co-operation of management and employees.

Boundary Waters Pollution Investigation

In 1946 the International Joint Commission was instructed by the governments of Canada and the United States to make an investigation of the pollution of boundary waters. The I.J.C. set up two boards of technical advisers, one for the State of New York and one for Michigan, to supervise the study and report. Dr. A. E. Berry and the author represented the Province of Ontario on both boards. In addition, the author was in charge of field work for the Canadian Section.

It was apparent from the start that the study would be a continuing one. Industrial expansion, changing processes, and changing products require a continuing check. Our principal problem was and is the Sarnia area, known locally as the "Chemical Valley" of Canada. The plan evolved to assess and control pollution in that area, both atmospheric and water, may be of particular interest.

Along the St. Clair River are located three oil refineries and three petro-chemical industries. Fortunately, the executives of these organizations are good citizens and, what is more important, progressive citizens who realize the value of public relations. The Imperial Oil Co. of Canada Ltd., the Polymer Corporation of Canada, and the Dow Chemical Company of Canada, cooperated with the regulatory authority in every way during the I.J.C. study. Imperial Oil Co. Limited spearheaded the organization of the industries in the area for a long term study of the area's problems, and a search for a solution of these problems.

Later two new refineries—Sun Oil Co. of Canada and the Canadian Oil Company — established refineries at locations south of the first three companies and joined the research group. Cabot Carbon has also established a plant in the area and become a member of the group. The Holmes Foundry was the last to join in the community effort. The City of Sarnia has also established a committee on atmospheric pollution—and the research group is represented on that committee in an advisory capacity.

The organization chart Illustrates the inter-relationship of the several groups, and a listing gives the personnel of technical members.

Cooperation of Local Industries

The work is financed by the government of Ontario, through the Industrial Waste Committee of the Research Council of Ontario, and by the industries themselves. Industry pays 50 per cent and the Research Council pays 50 per cent of the costs. The industrial portion of the cost is divided among the participating industries according to their number of employees. To direct the work, a local research group was established. The chairman of the local group is one of the industrial representatives, and changes annually.

The committee arranged with the Ontario Research Foundation for services of scientific personnel and use of equipment for making the study presently being conducted of atmospheric pollution in the area.

The study of water pollution was undertaken by the industries. Every Tuesday each industry drawing process water from the St. Clair River made complete chemical analyses of an 8-hour composite of its untreated process water. In addition, composite samples were taken at Point Edward (above all sources of industrial pollution on the Canadian Side) and at Corunna (below all sources of industrial pollution in the Sarnia area). The analytical methods used throughout were the same as those employed during the I.J.C. investigation.

Air Pollution Studies Underway

The industries also undertook the examination of their stack gases, and of atmospheric pollution within their own premises.

The scientists from the Foundation have located dust cans, Thomas autometers, anemometers, etc., in appropriate locations. As the study is still in its infancy, it would not be right to draw conclusions from the first report. However, the indications cited are: "As a protective measure, a concentration of 0.15 ppm of SO_2 for a continuous period of 8 hours is

taken as the danger point at which plant damage becomes at least a remote possibility. Our records show that these conditions have not been reached during the period under review."

Biological Oxidation of Phenols

Early in October, 1953, prior to the initial processing operations at its Sarnia refinery, the Sun Oil Co. Ltd. developed plans and initiated construction of facilities for the biological oxidation of phenolic compounds in the refinery wastes. The speed of design and construction of these facilities was made possible by investigations other companies had made of this problem. The results of these studies were made available to the Sun Oil Co.

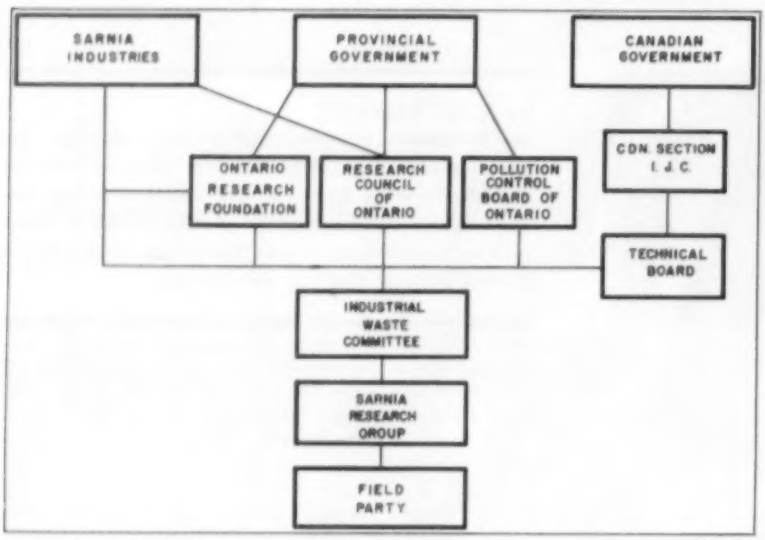
The Dow Chemical Company of Midland, Michigan, has studied the bio-oxidation of phenols for many years. The Imperial Oil Co. Ltd. had recently completed a study of the Dow processes as applied to oil refinery wastes. Throughout the period of design, construction and initial operation, the information on bio-oxidation received by these companies was supplied by Messrs. A. D. McRae of the Imperial Oil Company, and T. J. Powers of the Dow Chemical Company. This co-operation enabled the Sun Oil Company to establish something like a record in the speed with which it placed in operation a full-scale dephenolization unit.

In the original design of the refinery sewer system, engineers of the Sun Oil Company anticipated that certain waste waters containing oxygen-consuming pollutants would require secondary treatment following primary gravity separation of oil. All drainage in the refinery was segregated into cooling water, contaminated storm drainage, uncontaminated storm drainage, sanitary sewage and process water sewer systems. The total of these effluent streams averages 14 million gallons per day. Over 90 per cent of the phenols, sulfides, mercaptans and other water soluble contaminants are found in the process water sewer system, which collects process condensate waters from vessels and towers, pump gland leakage and desalting waste water.

Phenol-Treating Equipment Installed

As shown in the flow diagram, Fig. 1, this process water waste flow, averaging 250 gpm, or approximately 350,000 gallons per day, flows through a concrete A.P.I. single-section gravity-type separator, for removal of free oil. At the outlet end of the separator, a self-priming centrifigal pump, rated at 500 gpm at 35 psig, transfers the waste water to an earth-wall oxidation basin, 90 ft. long, 65 ft. wide and 10 ft. deep.

The waste enters the bottom of the basin through a nest of 40 Penberthy mixing eductors. A rotary compressor, rated at 500 cfm at 7 psig, pumps air to the eductors to supply oxygen and to provide intimate mixing. Overflow from the aeration unit discharges through a peripheral slit-pipe flume to a large concrete A.P.I. gravity



ORGANIZATION CHART—Illustrating relationship and cooperating organizations

TECHNICAL PERSONNEL

Research Organizations Cooperating in Pollution Studies

Research Council of Ontario

Dr. R. K. Stratford, Chairman, Scientific Adviser, Imperial Oil Co. Ltd.
Mr. D. W. Ambridge, President, Abitibi Power & Paper Co.
Dr. G. P. Gilman, President, McMaster University.
Dr. A. R. Gordon, Dean of School of Graduate Studies, University of Toronto.
Dr. G. E. Hall, President, University of Western Ontario.
Mr. H. Lawson, Vice-President, York Knitting Co.
Dr. W. A. MacIntosh, Principal, Queen's University.
Dr. W. E. Phillips, President, Fibre-Glass & Duoplate Glass Co.
Dr. G. N. Rhunke, Director of Research, Ontario Agricultural College.
Dr. S. E. Smith, President, University of Toronto.
Dr. H. B. Speakman, Director, Ontario Research Foundation.
Mr. H. M. Turner, President, Canadian General Electric.

Industrial Waste Committee of the Research Council

Dr. A. C. Plewes, Chairman, Head Chemical Engineer, Queen's University.
Dr. A. E. Berry, Sanitary Engineer, Ontario Health Dept.
Mr. A. V. DeLaporte, Chemical-Engineer-in-Charge, Experimental Station, Ontario Health Dept.
Dr. W. J. Harkness, Director, Division of Fish and Wildlife.
Prof. G. D. Lea, Professor Civil Engineering, Queen's University.
Mr. H. S. Matthews, Matthews Wells Co. Ltd.
Dr. R. R. McLaughlin, Dean of Engineers, University of Toronto.
Mr. Alex. McRae, Imperial Oil Limited.
Mr. W. C. Miller, City Engineer, St. Thomas, Ontario.

Local St. Clair Research Group

Mr. Alex. McRae, Chairman, Imperial Oil Limited.
Dr. A. E. Berry, Ontario Department of Health.
Mr. F. Bremner, Dow Chemical Co. Limited.
Mr. L. D. Dougan, Polymer Corporation.
Mr. R. N. Johnston, Director of Research, Dept. of Lands and Forests.
Dr. A. C. Plewes, Queen's University.

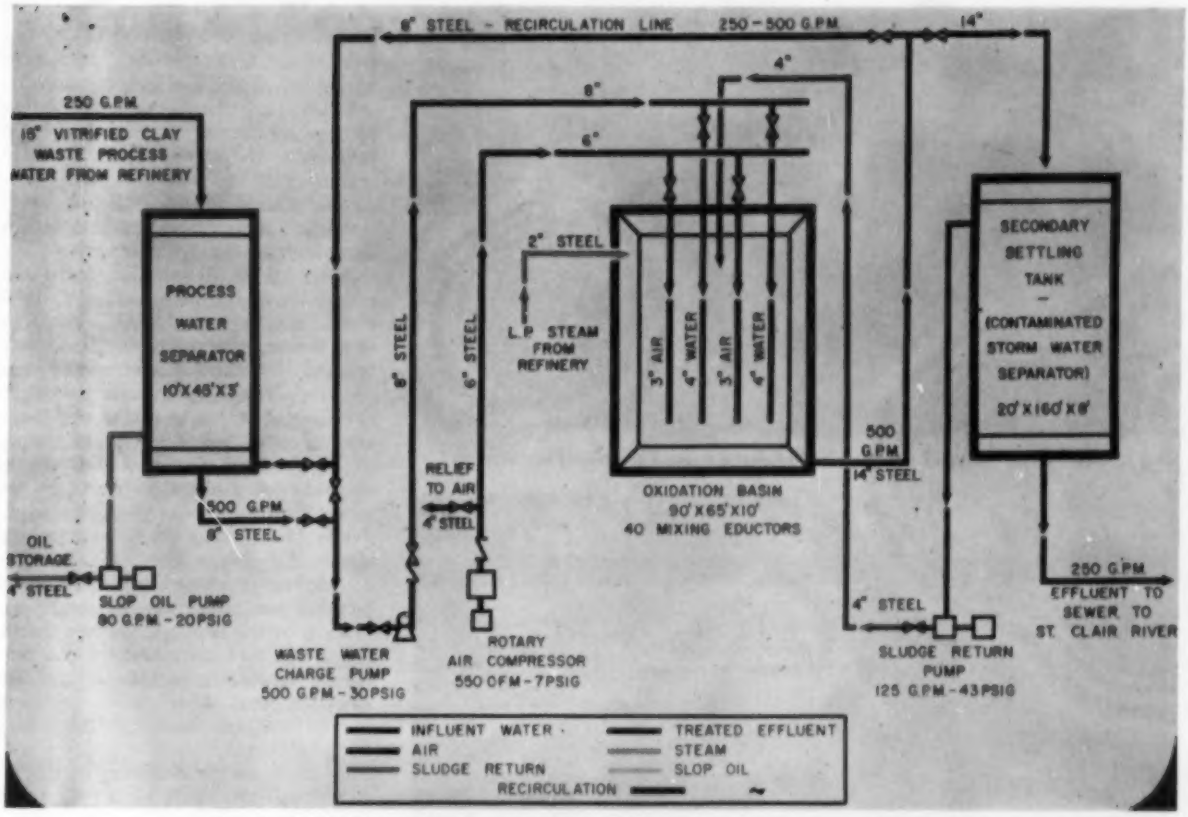


Fig. 1—FLOW DIAGRAM, phenol oxidation facilities, Sun Oil Co., Sarnia, Ontario

separator, originally designed for oil-removal service.

This second separator is equipped with continuous flight scrapers, and serves as a secondary tank for settling bacterial sludge. A positive displacement type, 125-gpm, 43-psig, sludge pump returns the settled bacterial floc to the oxidation basin; the treated effluent flows from the secondary separator to the St. Clair River. Piping has been provided to recirculate all or a portion of the oxidation basin effluent during periods of low volume feed or when the refinery is shut down. The process water waste separator and the oxidation basin are illustrated in Figs. 2, 3 and 4.

These modified activated sludge type facilities were placed in operation during November, 1953, in time to treat the first waste waters discharged from the refinery. Two tank truck loads of bacterial sludge from the Dow Chemical Company waste treatment plant at Midland, Michigan, were utilized for initial seeding. The approximate cost of the new facilities was $25,000. This does not include the value of previously installed equipment, which includes the process separator, secondary settling tank, the sludge return pump and the process water collecting system.

Report on Operating Experience

Experience through the first five months of operation indicates the initial phenol content of the process waste feed to be 100 to 150 lbs. per day. Numerous start-up and mechanical difficulties, as well as climatic conditions, have interfered with continuous and efficient performance. Nevertheless, over 95 per cent removal of phenol and 100 per cent removal of sulfide has been effected when operating conditions are normal and equipment is performing properly.

Efficient operating conditions include a bacterial sludge volume index of 3 to 4 per cent, a temperature range of 65 to 80°F, and a pH range of 7.0 to 8.5. Experience indicates that the process will operate at a temperature as low as 60°F. Dissolved and emulsified oil concentrations as high as 150 to 200 ppm, phenol concentrations up to 200 ppm, and sulfide concentrations as high as 250 ppm, have had no pronounced harmful effect on the biological activity. In the case of all such factors, it is important to avoid sudden or "shock" loadings whenever possible. It has been noted that the organisms can remain inactive for several days under adverse conditions, and then regain their former activity with the return of normal temperature and food supply.

Each jet aerator or eductor in the oxidation basin supplies 50 lbs. of oxygen, or a total of 2,000 lbs. of oxygen per day is applied from the air pumped into the waste water to oxidize the 100 to 150 lbs. of phenol; this is considerably in excess of the theoretical amount required. The aeration tank loading is equivalent to 5 pounds of phenol per 1,000 cubic feet of tank volume, and the applied air rate is equivalent to 0.1 cubic feet per minute per square foot of aeration surface. Total power requirements amount to approximately 60 hp.

Among the difficulties encountered in operation, low temperature (below the 55°F minimum) has been the most troublesome. Steam, when available from the refinery, is introduced through 1-in. diam, steel pipe coils with submerged exhausts into the oxidation basin. Recently, a direct-contact 2,500,000 BTU/hr. water heater has been installed.

High oil content in the influent, although apparently not toxic to the organisms and actually partially oxidized, is adsorbed on the biological floc and floats the latter to the surface

Fig. 2—GENERAL VIEW of separator and phenol oxidation treatment installation

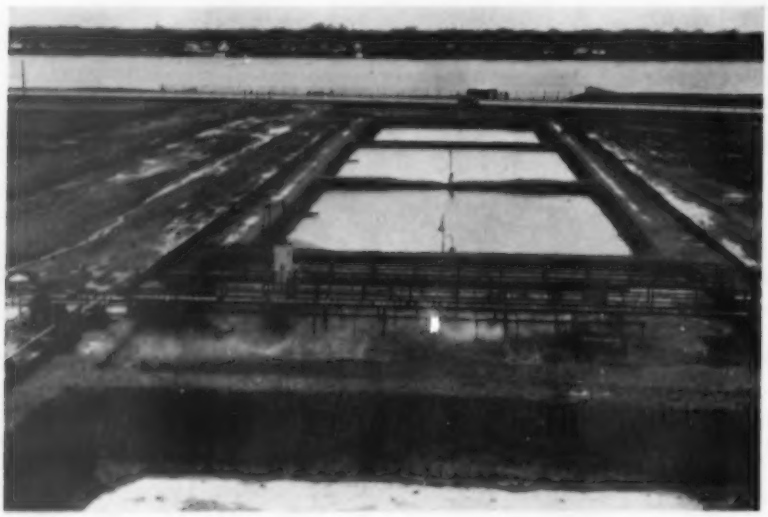


Fig. 3—OXIDATION BASIN for treating refinery wastes in operation

Fig. 4—AERATION UNIT uses forty Penberthy eductors for mixing

of the basin thereby removing organisms from the process. Change in feed water characteristics, including variations in pH, and in type and concentration of phenolic content, interferes with the acclimatization of the bacteria to the waste water. The secondary settling tank, originally designed as an oil separator, is oversized and not of conventional design for biological sludge recovery.

Mechanical difficulties with the pumps during initial operating and the usual start-up problems associated with a new refinery presented difficult operating conditions. There have been periods, for example, when the refinery units were not operating, and there was no continuous flow of waste process water. During such periods, it was necessary to recirculate water in the biological treatment unit; chemical-grade phenol was used to continue the food supply.

Additional experience, warmer weather and continuous normal operation of the refinery are permitting more effective operation of the biological treatment facilities. It is anticipated that additional equipment will be installed to maintain continuity of operation.

A check on the efficiency of dephenolization was made by a field party of the Canadian Section of the International Joint Commission in late January 1954. The phenol removal at the time of the tests was better than 95 per cent. The average amount of phenol discharged daily to the river was 5 pounds. Mr. Gordon Henderson, Manager of the Sarnia Refinery of the Sun Oil Company, and the Company management can well be congratulated on this contribution to pollution abatement in general and of the International waters in particular.

The details of the treatment plant, dimensions, equipment, operation, etc., were made available by Mr. H. F. Elkin of the Engineering Division of the Manufacturing Department of the Sun Oil Company. The author wishes to express his appreciation to the officials of the Sun Oil Company and to Mr. Elkin in particular for cooperation in making this material available.

W&SW

"Firewater"

Not long ago a gallon glass jug of water was left standing on the back porch of a residence. After a while the porch began to smoke, then it blazed, and soon the house was in flames.

What caused the fire? The sun's rays, magnified while passing through the jug of water, ignited the wooden porch.

Tubular Conveyor Has Many Uses

Multi-plane operation of circular discs assembled on link chain conveys bulk materials in pipes up to 12-inch diameter

by FRED E. STUART, Jr.

Mr. Stuart is a member of the engineering staff of Stuart Corporation, Baltimore, Md. His article has been prepared to describe more fully an enclosed tubular conveyor which has many applications in the sewage treatment field. This equipment is custom engineered for each plant application.

INDUSTRIAL needs existed for an enclosed conveyor capable of operating in more than one plane and of handling a variety of bulk materials. The Hapman tubular conveyor was designed to fulfill these needs.

Basically the tubular conveyor consists of a series of solid circular flights or discs mounted at intervals on a patented sealed-pin chain. This assembly operates within a tubular casing and is driven by a special sprocket which engages the chain in a drive box. Continuous operation of the endless chain assembly through an enclosed tubular casing allows material to be conveyed from one or more receiving points to one or more discharge points.

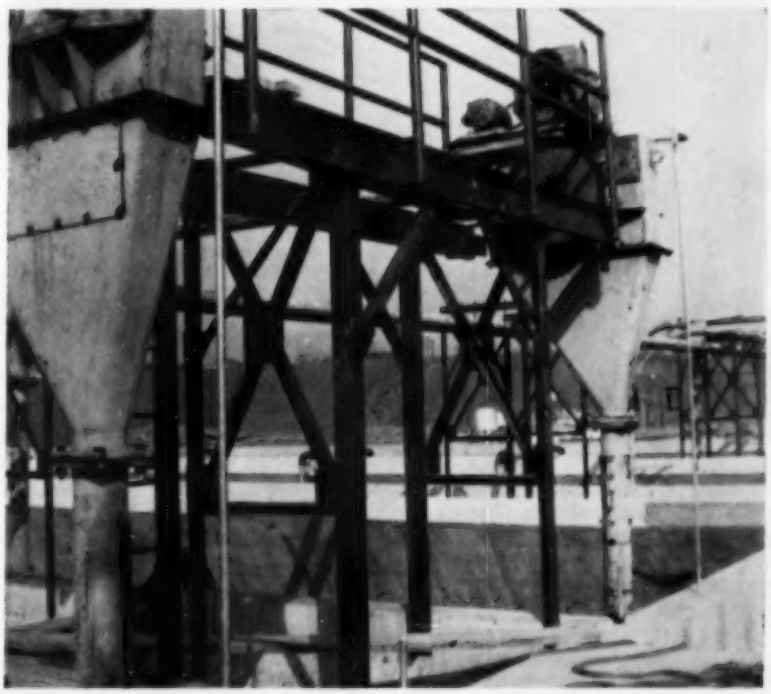
Sealed Pin Chain Assembly

The chain consists of an assembly of side links and center links connected by hardened pins with Neoprene washers assembled under compression between parts of the chain linkage, to prevent particles of flowable materials being conveyed from reaching the pins and causing wear as the chain articulates. This special engineered design and assembly effectively seals off a pin from any abrasive materials; thus the term "sealed pin chain."

This patented "sealed pin" chain design utilizing hardened pins for longer life is only one of the features provided by the custom engineering. When this special design is compared to an open jointed chain in which conveyed materials act as an abrasive compound as the chain flexes around sprockets and bends, the results of longer life and lower maintenance even under the most severe conditions are obvious.

Flight Construction Advantages

Extensive testing and experience has proven that Neoprene flights are ideal on most applications. Special conditions, however, have warranted the use of special materials such as cast iron, bronze, magnesium, plastics, etc., for flight construction. The Neoprene flights are bonded to or bolted between steel back up attachments to form a solid disc which in effect makes for a positive displacement of the material as the chain assembly moves through the tubular casing. While in the smaller size conveyors the flights are made up of solid Neoprene discs, in the larger sizes the flights are made up of Neoprene rings or tires which allow for weight reduction, as well as repositioning to compensate for wear.



GRIT HANDLING—Installation of Hapman conveyor at Birmingham, Ala., sewage plant

On an average, the flights have an area quivalent to about eighty percent of the cross sectional area of the tubular casing. It should be noted that these flights are mounted eccentrically on the chain with the result that as the chain moves through the conveyor path, it can actually twist through the pipe with the "heel" of the flight in contact with the inner radii of the bends. This engineering feature allows for the very desirable multi-plane type of operation.

The natural resiliency of the Neoprene, the durometer of which is very closely controlled, actually allows hard, abrasive, granual materials to literally "roll by" the flight in many cases, subsequently reducing the sliding friction at the point of contact. The use of abrasive-resistant Neoprene has also proven to have the advantage of quiet operation, which is considered important in many cases.

Speed and Capacity Ranges

The Hapman tubular conveyor is generally designed to operate within

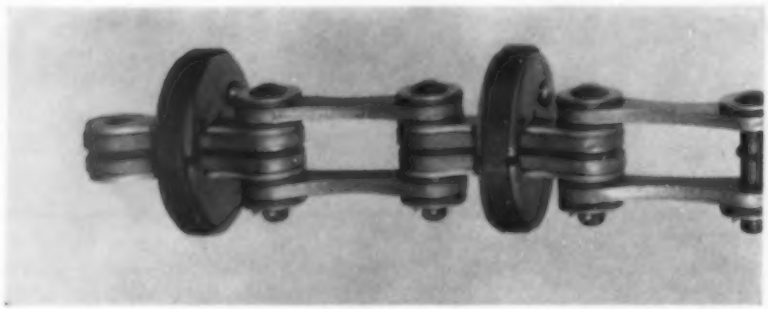


Fig. 1—SEALED PIN chain assembly, washers under compression protect hardened pins

Fig. 2—CIRCULAR FLIGHTS, usually of Neoprene, are off-center to follow pipe bends

standard pipe sizes ranging from 2-in. to 12-in. nominal diameter. These conveyors have been designed to operate at speeds from less than one foot per minute to over one hundred feet per minute although the average speeds usually range between twenty and sixty feet per minute. The conveyors are capable of handling material from pilot plant proportions up to over one hundred tons per hour. A four-inch tubular conveyor can readily handle between five and ten tons per hour of material depending upon the chain speed, density of material, etc., while a six-inch conveyor has about double the capacity of the four-inch unit.

Special ability of a conveyor to operate in more than one plane cannot be overemphasized, as this feature frequently allows a single unit to be installed where space limitations or obstructions prevent the use of a combination of several larger conveyors. The larger conveyors would require additional room for the several drive units as well as the transfer connections. Design of this chain is such that it has a natural tendency to twist inside the conveyor casing as it follows a very complex path through several planes.

Multi-Plane Operation Features

As can be seen in Figures 1 and 2, the axis of the flight is located off-center from the axis of the chain. Off-center mounting allows the "heel" of the flight to ride the inside radius of the bend with the chain twisting of its own accord so that the "heel" of the flight repositions itself to the inside radius of subsequent bends as the conveyor changes planes of operation. While a certain distance is required for this twisting action it is relatively short depending upon the size of the conveyor together with the speed of operation. The "sealed-pin" feature of the chain assembly remains in effect during this twisting action.

The many advantages of this multi-plane operational feature are obvious. As an example, a single unit could be used to pick up material in a horizontal plane, elevate the material several floors, and then carry it in another direction or to another building for discharge to hoppers or storage bins. By eliminating the use of a series of conventional conveyors, transfer points and their disadvantages can be also eliminated, as can the initial cost and the operational cost of a series of individual drive units.

The chain assembly is driven by means of a special hardened sprocket, which may operate in a 90° corner type drive box, a 180° type drive box or a special box of non-standard design depending upon the circuit layout. Frequently the take-up adjustment is included in the design of the drive box, although in some instances the take-up box is a separate unit. Figure 2 illustrates the engaging action of the sprocket with the chain.

Power Requirements Are Low

A relatively low horsepower motor is usually required for drive operation, with specially selected gear reducers being used to provide the normally low rpm output to the conveyor drive sprocket. As an example of the power requirements, an eight-inch conveyor has been operating for years carrying an abrasive material (with a density of 95 pounds per cubic foot) up an incline of 30° for a distance of 110 feet, utilizing only a 3-horsepower motor.

Since this conveyor operates in a totally enclosed circuit, many industrial concerns have realized its advantage to convey materials that may be extremely dusty or which may have obnoxious odors. This type of conveyor may also be easily constructed to be completely watertight, which is most desirable when materials with a high moisture content are to be handled. Such applications where the above features are required include the handling of powdered chemicals, fine talc, carbon black, sewage grit, spent brewery grains, etc.

No internal lubrication of the conveyor is required, as the conveyor chain has no lubrication points. Only normal maintenance lubrication of the drive motor and gear reducer is necessary. Gasketed inspection openings consisting of half-pipe cutout sections are designed and fabricated in the conveyor to facilitate chain installation and allow for ease in chain inspection. The conveyor casing of standard pipe is fabricated into required lengths and flanged to allow for simple field erection. The conveyor casing has a heavy wall thickness and its inherent strength frequently eliminates the necessity of additional supporting structure.

Fitted to Unusual Conditions

Specially designed gates may be

used at multiple discharge points and can be manually or automatically controlled to allow for the desired flow of material into the proper bins with very simple operation. This type of conveyor is frequently used to convey more than one material, and in some cases both the carry and return runs of the conveyor have been put to separate uses. Construction of the equipment is such that the conveyor casing may be jacketed or insulated in a very simple manner, to effect heating or cooling of the material being conveyed. Minimum space is required for the conveyor which in many cases has proven to be an extremely desirable feature, inasmuch as this conveyor can be fitted between other equipment and through existing supporting structure where conventional conveyors could not be installed.

In some installations the characteristics of the material being conveyed are such that a normal gravity discharge is not satisfactory. In such cases, the patented Hapman Unbalanced Load Noiseless Vibrator may be used for positive material discharge and depending upon existing conditions, air and water jets can be used to effect material discharge.

Test equipment is available in the manufacturing plant at Kalamazoo, Mich., and many industrial concerns have purchased this type of equipment after their engineers have observed actual tests on their particular materials. Tests have indicated such additional advantages as minimum particle contamination, minimum particle breakage, the explosion or flame supression advantage of the tubular conveyor, and also, the vapor type protection provided, which allows handling of hygroscopic materials.

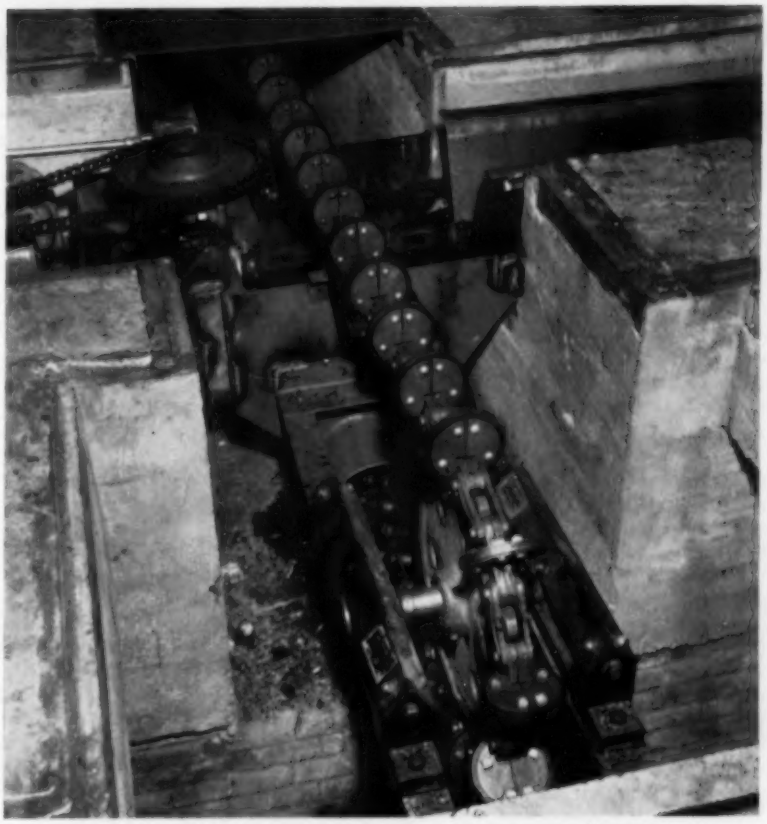


Fig. 3—SPROCKET and chain engagement of tubular conveyor is illustrated

This type of equipment is custom engineered for each individual application and accordingly the advantages are varied in each case.

W&SW

New Pipeline Rushed for Cheyenne, Wyo., Supply

With reservoirs at the lowest point in history, Cheyenne, Wyo., is rushing construction of a new pipeline project to boost municipal water supplies.

The pipeline and a new water well field—part of a $700,000 project—will be a major aid in supplementing the city's main water source in the Pole Mountain area to the west of the city.

Cheyenne's 30,000-plus residents live under tight water restrictions. Use of water for irrigation and lawn watering is limited to two four-hour periods a week. More than 400 residents have drilled their own wells to get water for such uses.

The $700,000 project will put nearly 5 million gallons of extra water into the city system when it is finished.

Desalting Water by Freezing Is Method Being Tested

According to press reports, a new method of converting sea water into fresh water by freezing and melting is undergoing exhaustive tests at University of Washington.

Dr. Thomas G. Thompson of the University's oceanography department developed the freezing-melting purifying technique with Kurt H. Nelson, a graduate student now at the University of Oklahoma.

Freezing sea water removes about 75 to 80 per cent of the salt and other minerals because these impurities do not freeze easily and settle to the bottom where they can be drained off. What salt and minerals remain are mostly washed away when the frozen sludge or mush first starts to melt.

How do You Rate as a Salesman?

They say a super-salesman is one whose wife expresses sympathy for the "gal" that lost her compact in his car.

"Fine Water Works Man you are! Won't even fix this leaking faucet! I just can't stand the noisy drip any longer!!"

Cincinnati's Industrial Waste Trailer

by ARTHUR D. CASTER

Mr. Caster is Principal Engineer for Sewage Disposal, Division of Engineering, Dept. of Public Works, City of Cincinnati, Ohio. He describes here a useful piece of equipment for gaging and analysis of industrial wastes discharged to a municipal sewer system.

ONE OF the essential activities included in the Greater Cincinnati Metropolitan Sewage Disposal Program is the gaging, sampling, and analysis of trade wastes discharged by some 700 industries into the sewer system and which eventually reach the sewage treatment works. Such an operation is necessary to establish equitable surcharge rates based on waste strengths and to protect the sewer system and treatment works from toxic and otherwise undesirable waste constituents.

It is imperative, therefore, that the field operation of flow measurement, sampling, compositing and pH determination, as well as the laboratory analyses, be carried out with the highest possible degree of precision and accuracy. Laboratory precision is relatively easily attained, but accuracy in the field presents a variety of problems. To combat these problems, engineers of the Sewage Disposal Section have developed and designed several items of special field equipment which greatly increase the accuracy of field determinations.

General Construction

Perhaps the most versatile and useful of these devices is the industrial waste gaging trailer designed entirely by the sewage disposal engineering staff and built by maintenance personnel of the Little Miami sewage works. It is fitted with a pneumatic flow recorder, an electrically operated pH meter, and a pH recorder. A self-contained gasoline engine generator and electrically driven air compressor enable use of the trailer away from an external power supply. The equipment is all fully automatic and the trailer could be left unattended if necessary, although it is not general practice to do so.

Figure 1 shows the general construction of the trailer.

The basic trailer is an Army surplus, two-wheeled, 1-ton unit with the body removed and replaced with a flat plywood bed. It is equipped with a standard ball-socket hitch, a hand brake and turn signals. Three jack-screws were installed, one on each rear corner and one on the front tongue, to serve as adjustable leg supports to enable the trailer to stand by itself. Red signal lamps on each corner are for purposes of identification at night.

Structural steel angles were welded together to form a rigid frame for the body box. The side and end panels are of marine plywood, hinged at the top for opening and exposing the instruments and other equipment. A generous amount of space is provided for tools and other items of equipment.

Flow Recorder and Power Plant

The pneumatic flow recording apparatus consists of a transmitter, a receiver, and accessories. The transmitter is of the air-bellows type providing an output air pressure directly proportional to the level over the crest of a 90° V-notch weir. It is actuated by a bubbler pipe system which converts the head on the weir to an increased pressure of from 3 to 15 psi.

The receiver operates with a corrosion resistant metal bellows and incorporates both a totalizer and a recorder. The totalizer is driven by a 110-volt ac motor; the recording chart is rotated by a synchronous electric clock mechanism.

The air pressure for the instrument is supplied by a 20-cfm electrically driven air compressor. The compressor is fully automatic and is furnished with a storage tank of 5-gallon capacity, intake air filters, and overload safety mechanisms.

Power for the compressor motor as well as all other electrical devices

Fig. 1—INDUSTRIAL waste gaging trailer unit is arranged for maximum convenience.

Trailer Equipment List

pH Meter and Accessories—Beckman Instruments, Inc.

pH Recorder—Minneapolis-Honeywell Regulator Company

Pneumatic Semi-Portable Recording Flow Meter and Accessories—Builders-Providence, Inc.

Air Compressor—Saylor-Beall, 1.63-CFH rating

Generator—Empire, 1000 w., 115 v., 60 cy., single-phase

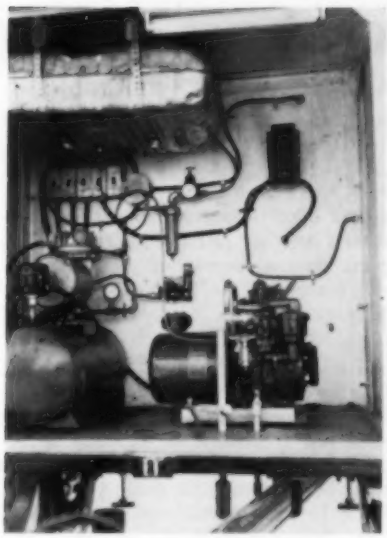


Fig. 2—GENERATOR and compressor bay.

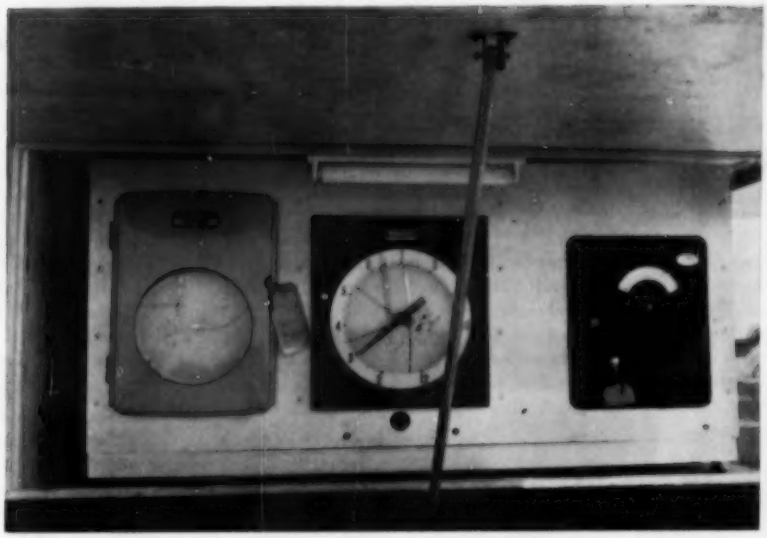


Fig. 3—INSTRUMENT panel includes pH and flow recorders.

on the trailer is supplied by a gasoline-driven, 115-volt, 60-cycle, single-phase generator with a 100-watt power output. However, if an outside source of electricity is available, it is used. Figure 2 shows the power plant and generator installation.

pH Meter and Recorder

The pH apparatus includes a potentiometer, a recorder, electrodes and accessories. The recorder chart is rotated by a motor drive operating at 115 volts. The electrodes are designed for direct installation in pipe lines or open channels and are protected from damage by floating solids. The potentiometer indicator and the recorder are mounted on the instrument panel with the flow recorder. The instrument panel is shown in Figure 3.

All of the instruments and their appurtenances are mounted on springs for cushioning against shock encountered while moving the trailer from place to place. The air tube for the flow meter and the leads on the pH electrodes are of sufficient length that the trailer may be situated a maximum of 50 feet away from the gaging and sampling point.

The compactness and self-sufficiency of the trailer make it extremely useful to the Sewage Disposal Section. It has been in service only a few months, but has already seen considerable use, mostly in conjunction with sewer damage investigations. The benefits derived from the use of the trailer are expected in a short time to more than compensate for the expense involved in its design and construction.

The following is an itemized account of the costs involved in the design and construction of the trailer:

Trailer (Army surplus)	$ 99
Flow recorder (incl. compressor and accessories)	1,300
pH meter and recorder (including accessories)	1,100
Generator	245
Materials of construction	390
Design	684
Construction labor	710
Total	$4,528

W&SW

Metal-Finishing Wastes Manual Describes Analytical Methods

"Procedures for Analyzing Metal-Finishing Wastes" is the title of a manual published by the Ohio River Valley Water Sanitation Commission in cooperation with its Metal-Finishing Industry Action Committee. The procedures represent an endeavor to provide methods that will screen-out substances which cause interference in the use of commonly accepted analytical techniques.

The 108-page report details nineteen methods recommended by the Committee following three years of intensive field-testing of procedures developed at Lehigh University where the American Electroplaters' Society has been sponsoring related projects on analytical work. The field-testing was carried out by member companies of the metal-finishing and other industry committees of the Commission as well as by the eight state regulatory agencies represented on the Commission.

Copies of the report, priced at $1.00, may be obtained from the Commission, 414 Walnut Street, Cincinnati 2, Ohio.

A 2-mgd Water Leak For Next Two Years

According to a press report, the Baltimore, Md., water system is losing, through leakage, as much as 2,000,000 gallons a day, and nothing can be done about it until 1956.

The leak, according to Bernard L. Werner, chief water engineer, is actually a series of leaks, caused by the expansion of steel and concrete joints in a 9-foot tunnel that carries water for half the city.

Because it handles so much of the city's water — perhaps 100,000,000 gallons a day—the tunnel cannot be shut down for repairs until other major installations are completed. These, Mr. Werner said, are the new Ashburton filtration plant, scheduled for completion in March, 1956, and a new 84-inch water main running from the Montebello filtration plant to the Pulaski highway, also scheduled for completion in 1956.

When these two additions to the water distribution system are in operation, it will be possible to bypass the old concrete-and-steel tunnel. With the flow of water through the tunnel shut down, a steel lining will be installed throughout.

It's Taste and Odor Time Again

An open letter from one water works superintendent to another

Dear Bill,

It's June again, the month of weddings, of rare days, of the longest day of the year, and the month when you and I and many other water superintendents begin to think about algae and tastes and odors. This is the month I begin to envy those fellows who have ground water supplies. This year I decided to attack my problems with a truly modern approach. So, I read a number of articles on tastes and odors in water supplies, and was surprised at how little I *really* knew about the subject.

Causes of Tastes and Odors

For one thing, I learned that these things we generally call tastes are really odors. Actually there are only four tastes: sweet, sour, bitter and salt. Occasionally maybe the water may be akin to bitter, but algae and such don't make water sweet, sour or salt, although they surely do affect the odor of the water. We have confused tastes and odors so long in our every day thinking that we continue to speak of tastes and odors in water supplies, although we determine these "tastes and odors" by the threshold *odor* test.

I've always thought that tastes and odors were caused by algae growths, decaying vegetation and industrial wastes, in that order of importance. Now I learn that there are some fungi which also cause odors. In particular it has been found that Streptomyces, one of the actinomycetes or ray fungi, are odor producers in water supplies.

Now these "bugs" are really soil bacteria, and require organic matter for growth. If there are cattails, eelgrass, saw grass, bulrushes, water lillies, etc., around the edges of a reservoir these fungi grow well. Where these "grass" growths do not occur, the actinomycetes can grow (proliferate is the word, I believe) using algae as the host, and source of nutrient organic matter. More than this, these organisms live and multiply on the walls of water mains where there are organic films or slime.

So it seems that even if you don't have enough algae or the right kind of algae to cause a really bad case of tastes and odors, you still can have these actinomycetes to "stink up" the water. Apparently these fungi grow well in warm water, not too deep, and they grow better in alkaline waters, but they will also grow in exposed mud flats where they impart their taste and odor substance to the soil. When the exposed earth is again covered with water these odor substances are leached out. Ever smell the bottom of an old mill-pond when it is drained—that's the odor.

These particular fungi apparently cause the water to have an "earthy" odor. From what I read, the people in the southwest are troubled most with this odor causing fungi, or at least they were the first to discover the real cause and identify it. But, when I think back to some of our previous troubles, I wonder if maybe our "earthy" odors might not have been due to these streptomyces and not to algae growth.

Of course we all know that the various algae forms have their own peculiar odor producing substances, and we know that petroleum wastes and phenol wastes, etc., have their own peculiar odors and that rotting vegetation will impart its own odor to water, but it's interesting to learn that there's another possible offender now. This may well explain why at times our odor troubles and algae counts don't seem to tie in. You must have had this same experience.

Testing for Odors

Whatever the cause or source of odor, I guess we all use the same method for determining how strong the odor is and how well our treatment is working to remove the taste and odor causing compound. This threshold odor test has been around for some years now. I can remember back to earlier editions of Standard Methods when it was reported in terms of "pO," but now we just sensibly call it Threshold Odor Number. (By the way, have you seen the new 10th Edition of Standard Methods—Quite a book, much bigger than the 9th, and greatly improved, I hear).

Speaking of Threshold Odor Numbers, we generally try to keep the T. O. No. in our finished water below 5, although I know that some of our consumers can detect a hot T. O. No. as low as 2.

Remedies

I guess you are like I am, you've tried everything in the book to eliminate or control tastes and odors. I used to drag sacks of copper sulfate crystals around our supply reservoir in a boat, but Elon Stewart of Syracuse, N. Y., and others, claim better results if you spray copper sulfate solution from the boat. It avoids streaks of concentrated solution. At Syracuse the solution feeder pumps are driven from the boat motor, thus proportioning the spray volume to the speed of the boat.

We've tried chlorine for some odors; never tried chlorine dioxide, although I understand it's particularly good for phenol odors, etc. Mostly we depend on activated carbon, or rather on copper sulfate for preventive treatment and activated carbon for remedial treatment, but sometimes we don't quite do the job we'd like to do.

Now that I've been reading about actinomycetes, I wonder if they could have been the cause of some of our odors (woody to earthy) that seemed to resist treatment. Apparently, copper sulfate has no effect on actinomycetes, and chlorine isn't too effective. Chlorine dioxide in 8 to 10 ppm doses will kill these fungi and their spores. Killing the spores is important too, since they will pass through filters, and become attached to the walls of pipe lines, where they will cause odors if the water gets above 60 degrees. I guess activated carbon in the plant is the best treatment if these fungi tastes and odors occur. Treatment of supply reservoirs with chlorine or chlorine dioxide is practically impossible and costly.

I understand that Dr. J. K. Silvey from North Texas State College at Denton, Texas, is an authority on these fungi, so if we get any more earthy odors in our water supply I'm going to call on him for help.—See you next month!

Yours, Fred

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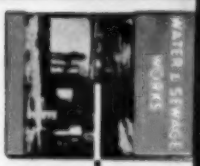

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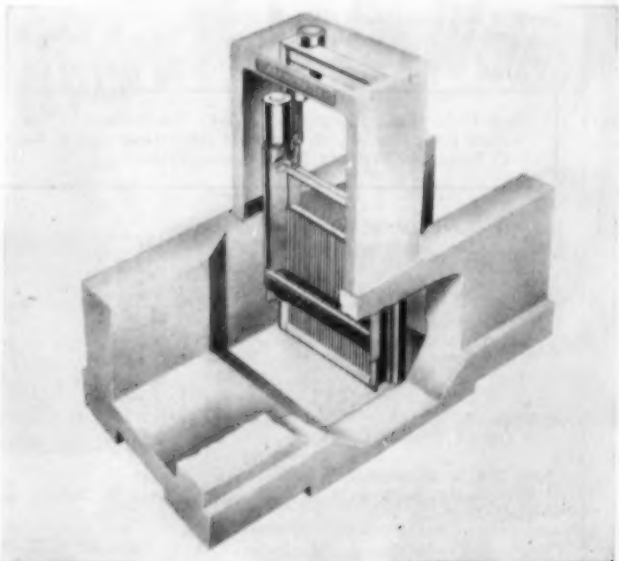

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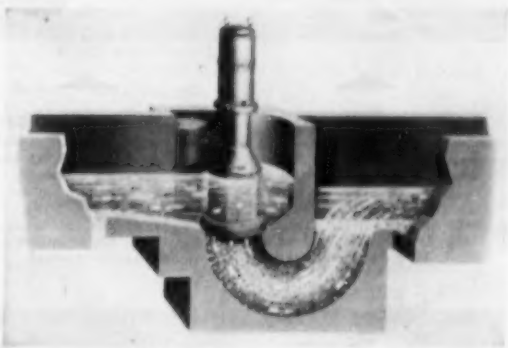

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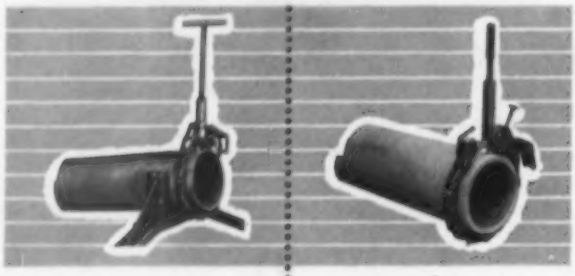

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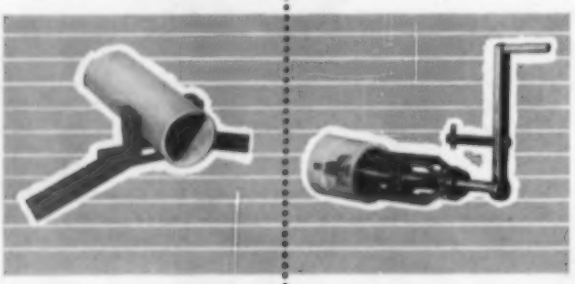

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Meetings Scheduled

Aug. 15—Richmond, Me.
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

Aug. 15-19—Blacksburg, Va., *(Virginia Polytechnic Institute)*
WATER & SEWAGE OPERATORS SHORT SCHOOL, Prof. J. D. Eye, V. P. I., Blacksburg, Va.

Aug. 22-24—State College, Pa. *(College Dormitories)*
PENNSYLVANIA WATER WORKS OPERATORS ASSOCIATION. Sec'y, R. Rupert Kountz, Penn. State University, State College, Pa.
(joint meeting with)

Aug. 22-24—State College, Pa. *(College Dormitories)*
PENNSYLVANIA SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, B. B. Bush, State Dept. of Health, Kirby Health Center, Wilkes Barre, Pa.

Sept. 7-9—Saranac, N. Y. *(Saranac Inn)*
NEW YORK SECTION A.W.W.A. Sec'y, Kimball Blanchard, 56 Grand St., White Plains, N. Y.

Sept. 7-9—Fort Dodge, Ia. *(Hotel Waukonsa)*
IOWA SEWAGE WORKS ASSOCIATION. Sec'y, L. F. Skorczeski, 207 South 15th Ave., Marshalltown, Ia.

Sept. 12-14—Lexington, Ky. *(Phoenix Hotel)*
KENTUCKY-TENNESSEE INDUSTRIAL WASTES & SEWAGE WORKS ASSOCIATION. Sec'y, S. Leary Jones, 420 Sixth Ave., Nashville, Tenn.

Sept. 12-14—Lexington, Ky. *(Phoenix Hotel)*
KENTUCKY-TENNESSEE SECTION A.W.W.A. Sec'y, J. Wiley Finney, Jr., 553 S. Limestone St., Lexington, Ky.

Sept. 14-16—Flint, Mich. *(Durant Hotel)*
MICHIGAN SECTION A.W.W.A. Sec'y, T. L. Vander Velde, State Dept. of Health, Lansing, Mich.

Sept. 18-22—Lake Placid, N. Y. *(Lake Placid Club)*
NEW ENGLAND WATER WORKS ASSOCIATION. Sec'y, Jos. C. Knox, 204 Tremont Bldg., Boston, Mass.

Sept. 19-21—Laramie, Wyo., *(Connor Hotel)*
ROCKY MOUNTAIN SECTION A.W.W.A. Sec'y, J. W. Davis, Johns-Manville Sales, Inc., Denver, Colo.

Sept. 21-23—Atlanta, Ga., *(Hightown Textile Bldg., Georgia Institute of Technology)*
24th ANNUAL GEORGIA WATER & SEWAGE SCHOOL, Secy. Treas., 1210 Hemphill Ave., N. W. Atlanta, Ga.

Sept. 21-23—Columbus, O. *(Neil House)*
OHIO SECTION A.W.W.A. Sec'y, M. E. Druley, Dayton Power & Light Co., Wilmington, O.

Sept. 21-23—Milwaukee, Wis. *(Hotel Schroeder)*
WISCONSIN SECTION A.W.W.A. Sec'y, Leon A. Smith, City Hall, Madison, Wis.

Sept. 21-23—Winnipeg, Manitoba, Canada *(Royal Alexandra Hotel)*
WESTERN CANADA WATER & SEWAGE CONFERENCE. Sec'y, W. J. Waddell, 3610 Manchester Road, Calgary, Alberta.

Sept. 25-27—Joplin, Mo., *(Connor Hotel)*
MISSOURI SECTION A.W.W.A. Sec'y, W. A. Kramer, Rm. 3, 6th Floor State Office Bldg., Jefferson City, Mo.

Oct. 4-5—Springfield, Ill. *(Place not selected)*
ILLINOIS WATER PLANT OPERATORS CONFERENCE, ANNUAL MEETING. Clarence W. Klassen, Chief San. Engr., State Dept. Public Health, Springfield, Ill.,

Oct. 10-13—Atlantic City, N. J. *(Ambassador Hotel)*
FEDERATION OF SEWAGE & INDUSTRIAL WASTES ASSOCIATION. (Annual Meeting). Sec'y, W. H. Wisely, 325 Illinois Bldg., Champaign, Ill.

(joint meeting with)

Oct. 10-13—Atlantic City, N. J. *(Ambassador Hotel)*
NEW JERSEY SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, M. S. Kachorsky, P. O. Box 766, Manville, N. J.

Oct. 11-14—Atlantic City, N. J., *(Chalfont Hotel)*
PENNSYLVANIA WATER WORKS ASSOCIATION (Annual Meeting) Sec'y, Davis Dunlap, 2609 N. Second St., Harrisburg, Pa.

Oct. 12—Norridgewock, Me.
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

Oct. 16-19—San Antonio, Tex. *(Gunter Hotel)*
SOUTHWEST SECTION A.W.W.A. Sec'y, Leslie A. Jackson, Robinson Memorial Auditorium, Little Rock, Ark.

Oct. 17-19—Pittsburgh, Pa., *(Hotel William Penn)*
16th ANNUAL WATER CONFERENCE, W. M. Porter, Sec'y., The Engineers Society of Western Pensylvania, Hotel William Penn, Pittsburgh 30, Pa.

Oct. 19-20—Clarksburg, W. Vir. *(Waldo Hotel)*
WEST VIRGINIA SEWAGE & INDUSTRIAL WASTES ASSOCIATION (9th Annual Meeting) Sec'y, G. O. Fortney, State Dept. of Health, Charleston 5, W. Vir.

Oct. 19-21—Des Moines, Ia.
IOWA SECTION A.W.W.A. Sec'y, H. V. Pedersen, Municipal Bldg., Marshalltown, Ia.

Oct. 20-21—Clarksburg, W. Va. *(Waldo Hotel)*
WEST VIRGINIA SECTION A.W.W.A. Sec'y, Harry K. Gidley, State Dept. of Health, Charleston, W. Va.

Oct. 20-22—Atlantic City, N. J. *(Madison Hotel)*
NEW JERSEY SECTION A.W.W.A. (Fall Meeting). Sec'y, C. B. Tygert, Box 178, Newark, N. J.

Oct. 24-28—New York, N. Y. *(Hotel Statler)*
AMERICAN SOCIETY OF CIVIL ENGINEERS. (Annual Meeting). Sec'y, Wm. N. Carey, 33 West 39th St., New York, N. Y.

Oct. 25-28—Sacramento, Calif. *(Senator Hotel)*
CALIFORNIA SECTION A.W.W.A. Sec'y, Henry F. Jerauld, 1040 Manzanita, Pasadena, Calif.

Oct. 26-28—Washington, D. C. *(Hotel to be announced)*
CHESAPEAKE SECTION A.W.W.A. Sec'y, Carl J. Lauter, 6955—33rd St., Washington, D. C.

Oct. 30-Nov. 2—Biloxi, Miss. *(Buena Vista Hotel)*
ALABAMA-MISSISSIPPI SECTION A.W.W.A. Sec'y, Charles W. White, 537 Dexter Ave., Montgomery, Ala.

Nov. 3-5—Richmond, Va. *(Jefferson Hotel)*
VIRGINIA SECTION A.W.W.A. Sec'y, J. P. Kavanagh, 213 Carlton Terrace Bldg., Roanoke, Va.

Nov. 6-9—Orlando, Fla. *(Hotel to be announced)*
FLORIDA SECTION A.W.W.A. Sec'y, Harvey T. Skaggs, P.O. Box 2328, Jacksonville, Fla.

Nov. 6-9—Orlando, Fla., *(Orange Court Hotel)*
FLORIDA SEWAGE & INDUSTRIAL WASTES ASSOCIATION (Annual Meeting) Sec'y-Treasurer, M. E. Dawkins, P.O. Box 210, Jacksonville, Fla.

Nov. 14-16 *(Place not selected)*
NORTH CAROLINA SECTION A.W.W.A. Sec'y, Wilber E. Long, Jr., 1615 Bickett Blvd., Raleigh, N. C.

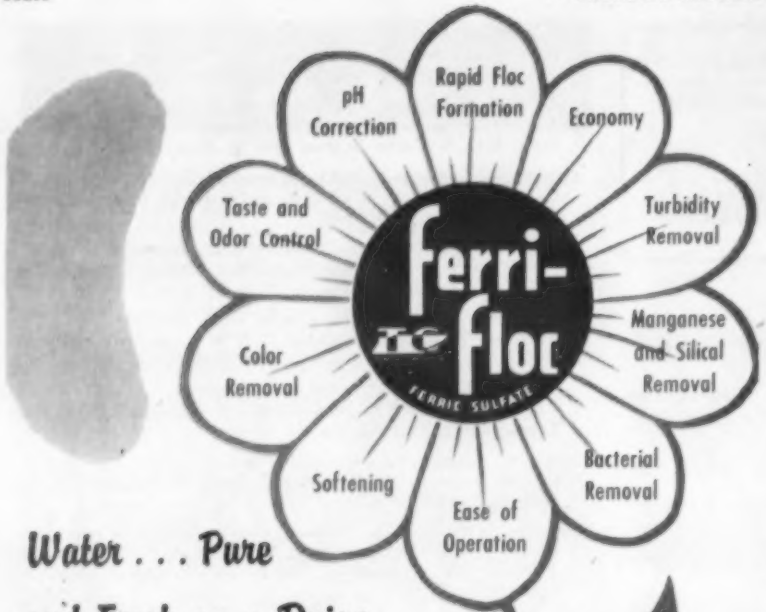
Nov. 14-18—Kansas City, Mo. *(Municipal Auditorium)*
AMERICAN PUBLIC HEALTH ASSOCIATION (83rd Annual Meeting). Exec.-Sec'y, Dr. Reginald M. Atwater, 1790 Broadway, New York, N. Y.

Dec. 14—Augusta, Me.
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

BUILDERS PROPELOFLO is an inexpensive main line meter for totalizing water consumption. Gives dependable, trouble-free service on the job. Meters accurately over wide range — six-digit totalizer shows water use directly in gallons, cubic feet, etc. For complete information on this easy-to-install meter, write to Builders-Providence, Inc., 350 Harris Ave., Providence 1, Rhode Island.

BUILDERS-PROVIDENCE
DIVISION OF B-I-F INDUSTRIES, INC.
BUILDERS IRON FOUNDRY • PROPORTIONEERS, INC. • OMEGA MACHINE CO.
B·I·F METERS FEEDERS CONTROLS

• If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.



Water . . . Pure and Fresh as a Daisy . . .

ferri-floc

the Superior Coagulant!

You can readily see why the many users of Ferri-Floc consider it the superior coagulant. Whatever your specific water treatment problem may be, you can figure on Ferri-Floc to do the job adequately, efficiently and economically. A partially hydrated ferric sulfate, Ferri-Floc is a stable, free-flowing granular salt which can be fed with few modifications through any standard dry feed equipment. It is only mildly hygroscopic, thereby permitting easy and safe handling, as well as storage in closed hoppers over long periods of time.

Water Treatment

Efficient coagulation of surface or well waters. Aids taste and odor control. Effective in lime soda-ash softening. Adaptable to treatment of nearly all industrial waters.

Sewage Treatment

Efficient coagulation over wide range of pH values encountered in sewage treatment. Especially adapted for conditioning of sludge prior to vacuum or drying on sand beds.

TENNESSEE TC CORPORATION

617-29 Grant Building, Atlanta, Georgia

SULFUR-DIOXIDE HIGHEST QUALITY SO_2 **Sulfur-Dioxide**

SULFUR-DIOXIDE is effectively used for dechlorination in water treatment and to remove objectionable odors remaining after purification.

COPPER SULFATE **Copper Sulfate**

COPPER SULFATE will control about 90% of the microorganisms normally encountered in water treatment plants more economically than any other chemical.

Free New Booklet!

Let us send you without charge a 38-page booklet that deals specifically with all phases of coagulation. Send postal card.

W&SW

New Equipment

Cifon, N. Y., Stops Sewage and Garbage Odors

701

Fine Organics, Inc., New York, N.Y., reports a rapidly increasing demand from cities of varied populations for their new sanitizing and deodorizing chemical, Cifon, N.Y. This highly effective sanitation chemical is used in the treatment of raw sludge in storage tanks, in the spray application at the vacuum filter exhaust and other vulnerable areas in the sewage treatment plant, and in the dosing of sand filter beds. In addition Cifon, N.Y. is said to prevent the generation of undesirable odors at garbage disposal dumps, remove slime, bacteria and fats from plugged up sewers, and for dousing garbage trucks.

Pneumatic Sump Pump

702

Schramm, Inc., West Chester, Pa., has announced a pneumatic sump pump that is designed with exceptionally large capacity so that dewatering or the handling of mud or raw sewage can be quickly accomplished.

Some of the features of the pump include: it can be dropped in the water, thus eliminating priming; it can be operated by any 105 or 125 c.f.m. compressor; it is small and light weight; easy to transport to the job; and requires little space for storage when not in use.

Glass Sealant Aids Meter Maintenance

703

Permatex Company, Inc., Brooklyn, N. Y., has announced that, the result of a recent field check disclosed that maintenance, service time, and expense on outside installations of water, gas and light meters can be cut substantially by application of a glass sealer.

Use of the company's glass sealer on each meter service-repair job is said to help preserve and prolong the

(Continued on page 104A)

1. Cost of Pipe

The important thing about this cost is that it represents only *one small part* of the piping picture and should not establish the only pipe comparison guide.

2. Cost of Installation

This cost generally represents the *major part of the piping investment* and includes labor, fabrication, valves, fittings, covering, and overhead.

3. Cost of Maintenance

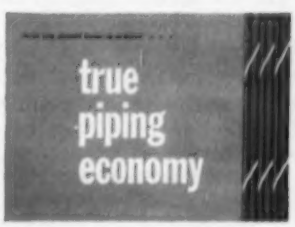
This is the money paid to keep the piping system in operation as long as the need for it exists. The amount spent depends largely on the quality of pipe used.

3 IMPORTANT COSTS THAT SHOW WHY WROUGHT IRON PIPE PROVIDES TRUE PIPING ECONOMY

This breakdown of piping system costs underscores the reasons why wrought iron pipe users enjoy maximum piping economy even though they pay more, *initially*. These users know that they buy an *installed piping system*, not just the pipe. And because the greatest cost of this installed piping system is in labor, valves, fittings, fabrication, covering, and overhead, the difference between the cost of the wrought iron installation and what a low-first-cost pipe installation would have been, shrinks to an insignificant amount in the cost of the *total piping contract*.

But still more important to the plans and pocketbooks of wrought iron pipe users is the Cost of Maintenance. One user put it this way. "A wrought iron installation is like having money in the bank." He was simply expressing wrought iron's longer service in terms of money saved in repairs, replacement, and maintenance. There's no doubt about it . . . when you consider the three costs, you can buy the best—wrought iron—and get a bargain at the same time.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. International Division: New York, N. Y. *Available throughout the world.*



Write for Booklet

The booklet, *True Piping Economy*, gives detailed information on the cost facts presented here, plus many others. You will find it a valuable guide in placing pipe selection emphasis where it will profit you most.

BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY STEEL PRODUCTS

life of both rubber and composition gaskets used in meters. Even when the gasket is completely deteriorated, Permatex glass sealer can be used without gasket replacement. Use of the sealant helps make the glass meter window water-tight and prevents dust and dirt from seeping inside the glass and obscuring fast reading of meter figures.

Non-Slam Check Valve

704

W. R. Ames Company, San Francisco, Calif., has developed a new spring-action check valve that assures closure without "slamming" and minimum resistance to flow.

The closing mechanism in the new Ames check valve utilizes a knuckle action with two springs acting at the joint of the knuckle. When the flapper is closed, mechanical advantage of the knuckle joint multiplies the spring pressure, holding the flapper tightly against the seat with much greater pressure than if the springs were acting directly on the flapper. This spring tension on the flapper actually closes the valve an instant before reverse flow commences, eliminating any valve hammering or chattering.

With the knuckle action reversing itself as the flapper swings open, the closing force actually decreases as the opening increases. Thus there is a minimum restriction against the flow when maximum flow through the valve is encountered. Closing force can be controlled by changing the characteristics of the springs.

MONTREAL
Uncovers
Continent's Oldest
CAST IRON
WATER MAINS

Recent excavations in Montreal, Canada, uncovered the oldest known water mains still in service on the North American continent.

The mains—several thousand feet of cast iron pipe—were laid 138 years ago to replace original wooden mains laid in 1800.

Historically interesting as was this discovery, the record revealed of more than a century-old cast iron pipe service is by no means unique. In Versailles, France, cast iron mains installed in 1664 are still functioning. In Germany there are several authenticated lines in use today after **two centuries** of service! And in many American cities the original cast iron mains are still in perfect condition after serving for generations.

Reason for the long life and long run economy of cast iron pipe is its effective resistance to rust. It is the one ferrous metal for water, gas mains and sewer construction that will not disintegrate from rust.

* * * * *

Our Company does not manufacture cast iron pipe, but produces quality iron from which quality pipe is made by many of the nation's leading foundries.

WOODWARD IRON COMPANY
WOODWARD, ALABAMA

Submersible Pump

705

Garvens U. S. A., Inc., New York, N. Y., has announced the reintroduction to the United States the Garvens Submersible Pump in 4 and 6 inch diameter sizes for 60 cycle operation.

The pumps are available in both the sealed stator and wet motor types of drive. The rotor runs in a special emulsion which prevents corrosion and aids in lubrication. The current line of pumps being offered has ratings from 200 to 3900 gph and settings to 450 feet.

HTH Tablet Basket

706

United Industries, Inc., Wichita, Kansas, has announced the development of a HTH Tablet Basket, with a 1 lb. tablet capacity for feeding chlorine.

The basket is filled with HTH tablets and lowered into the pool or lake to be chlorinated. It is left there until the desired chlorine residual is reached. The basket can also be used for the feeding of Copper Sulfate, Calgon, or any other chemical of large crystalline character.

Rotary Seal Cartridge for Fluid Mixers

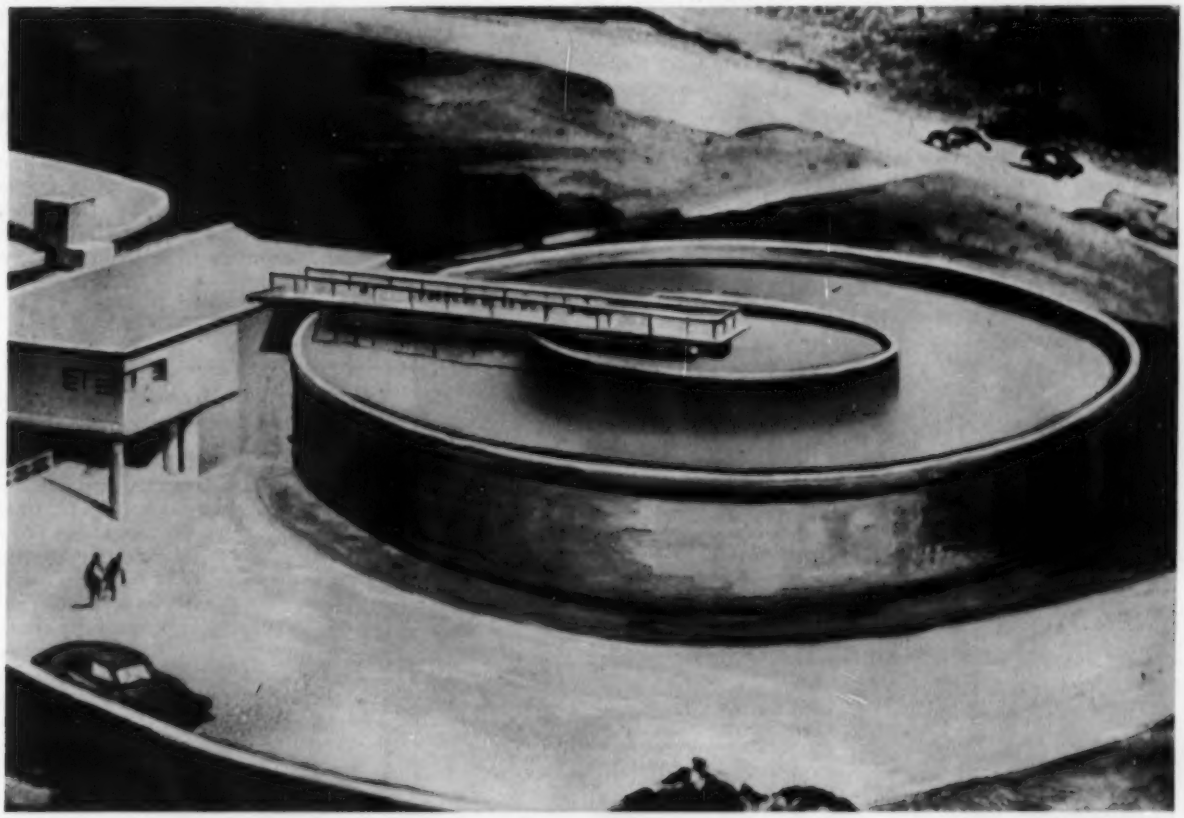
707

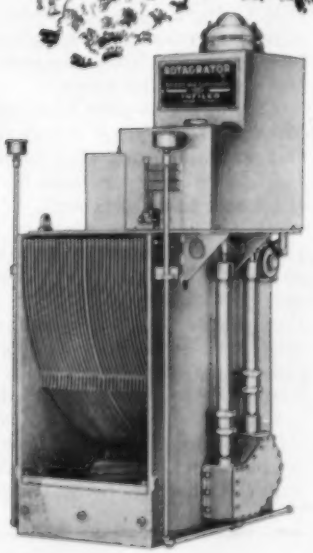
Mixing Equipment Co., Inc., Rochester, New York, has developed a new rotary mechanical shaft seal in an easily-replaceable cartridge assembly.

This new seal has been designed especially for service in fluid mixing applications. It is now available, in either single or double types, on all models of Lightnin Mixers where shaft sealing is required, and in a variety of materials to suit any fluid mixing conditions.

(Continued on page 106A)

AERO-ACCELATOR (Trade Mark) Treatment Plants provide complete sewage treatment at lower cost!





The "AERO-ACCELATOR" treatment units provide high rate sewage treatment (overall BOD reduction better than 90%) at *low cost*. Embodying the latest concepts of activated sludge processing and solids separation, this compact unit requires a detention time of only 4 hours at average flow for complete secondary treatment. This means important savings for any community or institution, regardless of plant capacity.

If you are planning a sewage plant, see your consulting engineer or write INFILCO regarding the economical "AERO-ACCELATOR" treatment unit.

NEW ROTAGRATOR® screen and comminutor

A revolutionary development for screening and comminuting *all* coarse sewage material without rejection or removal from the flow. Reduced head loss, straight-channel installation and low power requirement. Eliminates odor and handling nuisances.

INFILCO

The one company offering equipment for all types of water and waste treatment—coagulation, precipitation, sedimentation, filtration, flotation, aeration, ion exchange and biological processes.

INFILCO INC.

923 South Campbell Ave., Tucson, Arizona

Field offices in principal cities in North America 6801

Positive, leakproof sealing of tank liquids, vapors or gases is provided by the new seal. Unlike a packed stuffing box, the seal never requires adjustment while in service. Field tests have shown that the seal can be expected to give years of trouble-free service under normal conditions.

The new Lightnin seal is assembled in a cartridge as a single component. Anyone, using only a wrench, can easily uncouple and remove the assembly, and replace it, in just a few minutes without dismantling the mixer or removing it from the tank, and without emptying the tank. Shaft alignment is automatic, and need not even be checked.

Grout Pump For Use With Vitrified Clay Pipe

708

The Clay Sewer Pipe Association, Columbus, Ohio, has announced that a member manufacturer has developed a grout pump mechanism utilizing a lever action and requiring five times less effort to operate than the previous model. The pump is used for the inflation of pressure joints on vitrified clay pipe. The mechanism, replacing a piston action pump, can be attached to any of the present grout pumps.

The pump consists of a reservoir for the grout mixture, a hand-operated pump, pressure gauge and hose with a nozzle. In pressure joint-equipped clay pipe installations, grout is pumped from the reservoir through the hose to the pressure joint, a hollow rubber gasket. The easy-to-operate hand pump supplies all the necessary pressure to properly inflate the joint. Pressure from the pump is measured by a dial indicator on the hose nozzle, making installation simple and efficient.

Hot Spray Vinyl For Corrosion Control

709

Prufcoat Laboratories, Inc., New York, N. Y., has announced the development of a new hot spray vinyl that was specifically engineered for the economical and effective control of corrosion.

The new hot spray vinyl will provide a 4 mils coating in a single spray pass. One prime and one hot spray coat will give the 5 to 6 mil total thickness needed in most corrosion protection work. Vinyl thickness in the 10 to 15 mil range without runs or sags are possible in an uninterrupted multiple pass spray application, with this new development.

New Filter Block Eliminates Hand Placement of Filter Stone

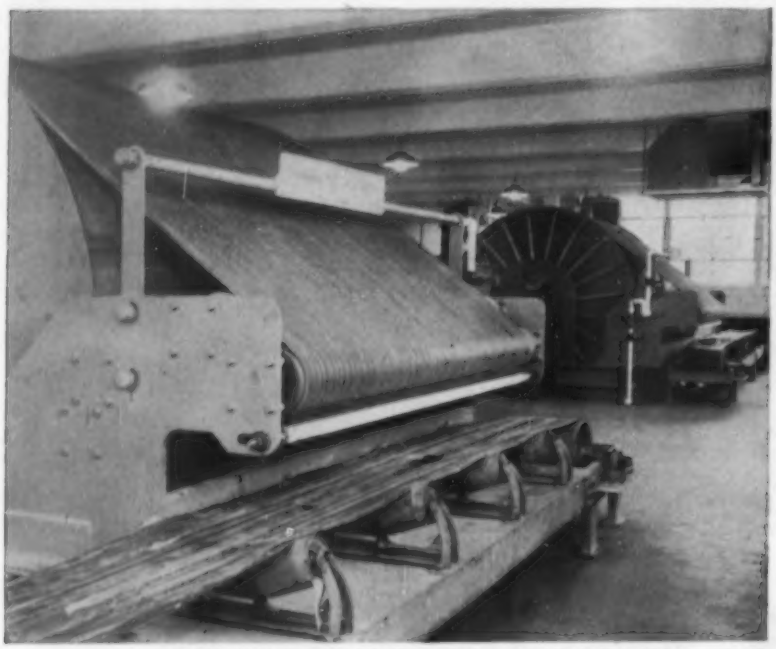
710

Straitsville Brick Co., New Straitsville, Ohio, has just developed Ceramifilter, a redesigned two-piece filter block that completely eliminates hand placement of filter stone.

This new two-piece block not only provides much larger runoff channels and aeration openings but, offers these features at no extra cost because it eliminates hand placement. With Ceramifilter, filter media can be deposited by clamshell at a saving of about $4.25 per ton of stone over the cost of hand placement. The cost of Ceramifilter floors, in place and covered, is no greater than ordinary one-piece filter block floors that require hand-placement of filter media.

Ceramifilter blocks are made from strong burning fire clay. Lower channel blocks feature 9/16 inch walls and sturdy center supports designed to

(Continued on page 108A)



Filter equipment in Darby Creek Joint Authority Sewage Treatment Plant, Darby Township, Pa.

In plants of any capacity,

Pennsalt Ferric Chloride simplifies sewage treatment

Whatever the capacity of your plant, Pennsalt Ferric Chloride, *in liquid or anhydrous form*, can increase your vacuum filter efficiency:

- **by superior coagulating and flocculating action;**
- **by increasing filter capacity;**
- **by producing drier, easier-to-handle cakes.**

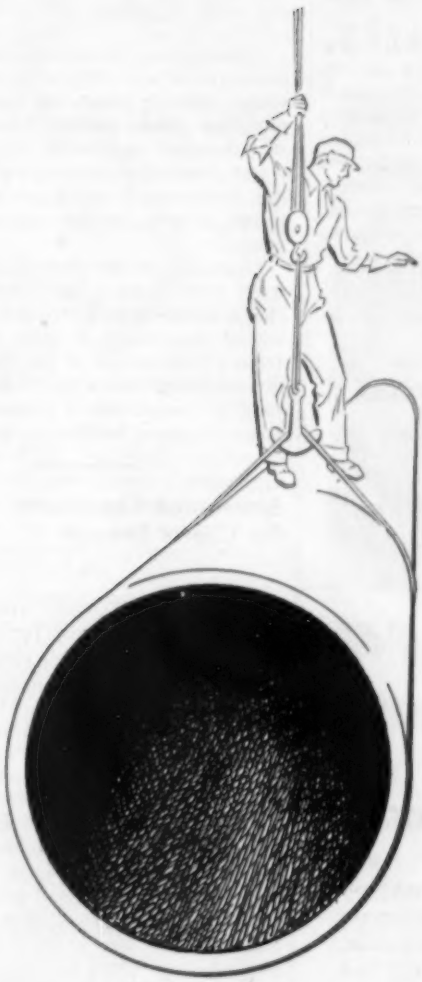
Write for free technical information on Pennsalt anhydrous and aqueous ferric chloride. Industrial Chemicals Department, Pennsylvania Salt Manufacturing Company, Three Penn Center Plaza, Phila. 2, Pa.

OTHER PENNSALT CHEMICALS FOR WATER AND SEWAGE TREATMENT: Alum, chlorine, chlorinated lime, Perchloron® (high-test calcium hypochlorite).

Pennsalt District Offices

Appleton, Wis.—Appleton 3-9307
Decatur, Ga.—Evergreen 9600
Chicago 1, Ill.—Andover 3-6170
Cincinnati 2, Ohio—Main 3166
Cleveland 15, Ohio—Main 1-6205
Detroit 26, Mich.—Woodward 1-9051
Paterson 1, N. J.—Lambert 5-3600
Philadelphia 2, Pa.—LOcust 4-4700
Pittsburgh 19, Pa.—Atlantic 1-8233
St. Louis 1, Mo.—Central 1-2338

Pennsalt Chemicals



Ford Picks Concrete For Pressure Sewer Line

The Ford Motor Company has a big assembly plant in Louisville, Kentucky. Their pressure sewer system is all concrete steel-cylinder pipe. It includes 16, 20, 24, 30, 36, 42 and 48 inch Price pipe.

Price pressure pipe is good for sewer force mains because it has *flexible bottle-tight joints* and *great strength*. It can be designed for any pressure sewer line 16 inches and up.

And it is good for just about any underground line, because concrete when buried, tends to return to its natural state of stone. It becomes virtually *ageless*.

Ford gets its water supply from the Louisville Water Company. It too is delivered through a line of Price concrete pressure pipe.

Study the advantages of ageless concrete for any type of water or pressure sewer line. Write for our catalog. There'll be no obligation.

Member American Concrete Pressure Pipe Association

Price Brothers Company

1851 East Monument Ave. · Dayton 1, Ohio

Concrete Pressure Pipe for Water Supply, Subaqueous, Pressure Sewer and Culvert Installations

withstand high stresses. Upper grill blocks are fully three inches thick and remain undamaged when filter media is loaded by clamshell.

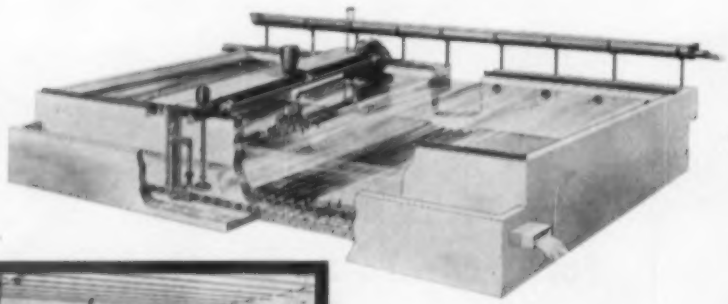
Hard Water Bypass For Zeolite Softeners

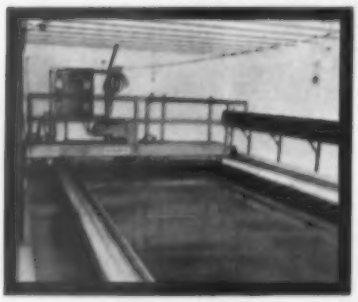
711

Graver Water Conditioning, New York, N. Y., has developed a hard water bypass to control the degree of hardness (in Zeolite Softeners) in water rather than complete softness.

This system controls the proportionate mixing of untreated hard water and treated, fully-softened water to produce whatever degree of hardness is desired.

The operation of the system is extremely simple. Only a single setting, on the adjustable orifice, need be made to regulate the ratio of hard water to soft. Valves are automatic and adjust rapidly and surely to flow variations of one to four, without any preceptible loss of accuracy. There are no pumps and there is a minimum number of moving parts.





12½′ x 40′ Hardinge Automatic Backwash Sand Filter in a municipal water plant in Vermont.

12½′ x 86′ Hardinge Filter handling water supply for a Canadian paper plant.

A sand filter which

CLEANS ITSELF

The Hardinge Automatic Backwash Sand Filter is a complete departure from standard filtration equipment, in that it backwashes its filter bed automatically without interrupting normal filtration.

The ABW filter in combination with flocculation and sedimentation equipment provides treated and filtered water for municipal and industrial water supplies.

The filter may be applied also for the treating of plant waste water, for reuse or disposal.

Complete specifications upon request. Bulletin 46-A-15.

HARDINGE
COMPANY, INCORPORATED

YORK, PENNSYLVANIA • 240 Arch St. • Main Office and Works

New York • Toronto • Chicago • Hibbing • Houston • Salt Lake City • San Francisco

Water Treatment Plant For Small Communities

712

Infilco, Inc., Tucson, Arizona, has developed a new, completely packaged water treating plant for small communities. Trade marked "Accelapak" it is designed to provide high quality water, treated at a cost well within the budgets of small communities, camps, resorts, estates and industrial plants.

Operation of the plant is simplicity itself with "once a day" charging of chemical feeders. The plant is interlocked electrically to start and stop from a float switch in the clearwell—thus reducing an operator's attendance time to a minimum. Capacities range from 15 g.p.m. to 250 g.p.m. and up.

Screen and Comminutor For Coarse Sewage

713

Infilco Inc., Tucson, Arizona, has developed a new unit for screening and comminuting rags, cans, rubber products, glass, rope, wood and all coarse sewage materials. The "Rotagrator"(R) screen and comminutor is designed for use by the larger communities with flows ranging from 1900 g.p.m. to 50,000 g.p.m.

The "Rotagrator" unit screens and comminutes such materials without rejection or removal from the flow. It functions at low head loss, holding solids upstream until they are comminuted to a size permitting passage downstream, thus enabling the machine to handle efficiently a wide variety of solids.

Straight line installation reduces initial costs and low power requirements reduce operating costs.

New Air Diffuser

714

Infilco Inc., Tucson, Arizona, has developed a new flexible, collapsible diffuser for introducing air or other gas into a liquid to produce agitation or to effect absorption or desorption. The "Colaflex"(R) diffuser maintains practically constant permability for fine diffusion of air or gas in sewage, industrial waste and waste treatment.

The flexible fabric diffuser element is easily cleaned merely by operating a three-way valve manually or automatically to cut off the gas supply and vent the diffuser to the atmosphere.

Upon venting, the fabric is collapsed by liquid pressure, and in-

verted downwardly into the diffuser pan. Alternate inverting and reinflation dislodges any solid particles on the fabric. The fabric is thus kept clean to permit continually effective diffusion, saving service and maintenance time.

Several diffuser elements can be connected to a common header or gas duct of any desired pattern within the tank in which the liquid is contained and provisions are made to maintain uniform gas dispersion to each element.

Close-Coupled Pump Motor

715

U. S. Electrical Motors Inc. has developed a new line of totally-enclosed and explosion-proof, close-coupled pump motors. Designed specifically for use with centrifugal pumps operating in dangerous, damp or dusty locations, the new motors are available in horsepowers ranging from 1½ to 25 H.P.

Special features include a face type registered mounting bracket for accurate shaft alignment and simplified pump mounting, precision ground

(Continued on page 110A)

MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

ROBERTS FILTER MFG. CO.
607 Columbia Ave.
Darby, Pa.

Up to 4 times the lifting capacity

Here the Hydrocrane eases a section of pipe onto a truck. Note how outriggers anchor the crane solidly to the ground — keep it level even on over-the-side lifts.

With Hydrocrane's Easily Set Outriggers

Four hydraulically operated outriggers that extend out and down in seconds not only multiply the Bucyrus-Erie Hydrocrane's lifting ability — but permit using a standard truck instead of an expensive crane carrier. With outriggers fully extended the Hydrocrane's lifting capacity is increased by as much as 4 to 1 on over-the-side lifts — where any crane's stability is lowest.

Outriggers an Operator Really Uses

Outriggers are individually controlled right from the operator's station, making it possible to level crane on uneven ground — without cribbing or blocking. Even with dozens of crane moves during a day, operators readily use outriggers because they're so easy to extend and retract.

Because the patented outriggers provide such solid stability, you can take full advantage of the Hydrocrane's precision hydraulic control — hold the crane steady for easy, rapid loading, hoisting and setting of pipe, valves, hydrants. Ask your Bucyrus-Erie distributor to show you with a demonstration on your own job. 69H55

BUCYRUS ERIE
South Milwaukee Wisconsin

1880 75 1955
YEARS OF SERVICE to Men Who Shape the Earth

shaft for accurate pump impeller mounting, and solid flange and brass slinger for complete liquid deflection.

The complete new line of pump motors has asbestos-protected windings, normalized castings, Lubriflush bearings and solid cast rotor.

Portable Oxygen Analyzer

716

Arnold O. Beckman, Inc., South Pasadena, Calif., has announced an addition to their line of Oxygen Analyzers, that provides a direct physical measurement of oxygen content without resort to catalysts, chemicals, filaments, glassware, etc.

The new instrument—designated the Model C2P Oxygen Analyzer—is particularly designed for applications requiring a quick, simple, accurate means of measuring oxygen with an instrument that is portable for convenient use in the field or laboratory.

The Model C2P can be used for measuring continuously-flowing samples, or for fixed volume samples as small as 3 cc. The instrument can be obtained in practically any desired range of 5% or more between 0 and 75% oxygen—and in ranges of 15% or more between 75% and 100% oxygen. These and many other ranges are available within the limits previously outlined.

Accuracies, in any range, are within ± 1% of full scale—a degree of accuracy made possible by the unique paramagnetic principle upon which the instrument operates. The measurement is a direct physical measurement of the oxygen itself, not of some variable secondary function or relationship.

Response is rapid—95% response to final reading within 40 seconds on standard models, or within 7 seconds on special models. The scale is direct reading and may be calibrated in either percent oxygen or millimeters of mercury oxygen partial pressure.

Remote Electrical Transmission Instrument

717

Simplex Valve and Meter Co., Lancaster, Pa., has just developed a new Orthoflow electric transmission system utilizing a two-wire circuit.

The unit was designed for installation where accurate transmission of flow or other measurable data is required over distances where it is not possible to obtain this data from mechanical measuring devices. It can be adapted to transmit data over private wires in in-plant services or, with the addition of a few simple parts, for use over leased telephone channels.

Polyvinyl Plastic 3-Rib Cellular Waterstop

718

Water Seals, Inc., Chicago, Ill., has announced that its new 3-rib Cellular Waterstop is receiving popular acceptance among builders and contractors throughout the country.

The new waterstop, only recently introduced, keeps joints watertight in spite of differential movement or straight separation. Three cells, built into the waterstop, compensate for both vertical and horizontal joint separation such as those experienced with slabs placed on ground where uneven settlement may be unavoidable.

(Continued on page 112A)

PRELOAD experience

for ALL your tanks

PRELOAD'S years of experience, plus its new policy of centralized engineering and licensing of qualified local contractors, covers the whole range of successful tank construction.

The clarifier tank (above) is but one of many types of prestressed concrete construction offered by PRELOAD. Over 1,000 tanks built are included in our record.

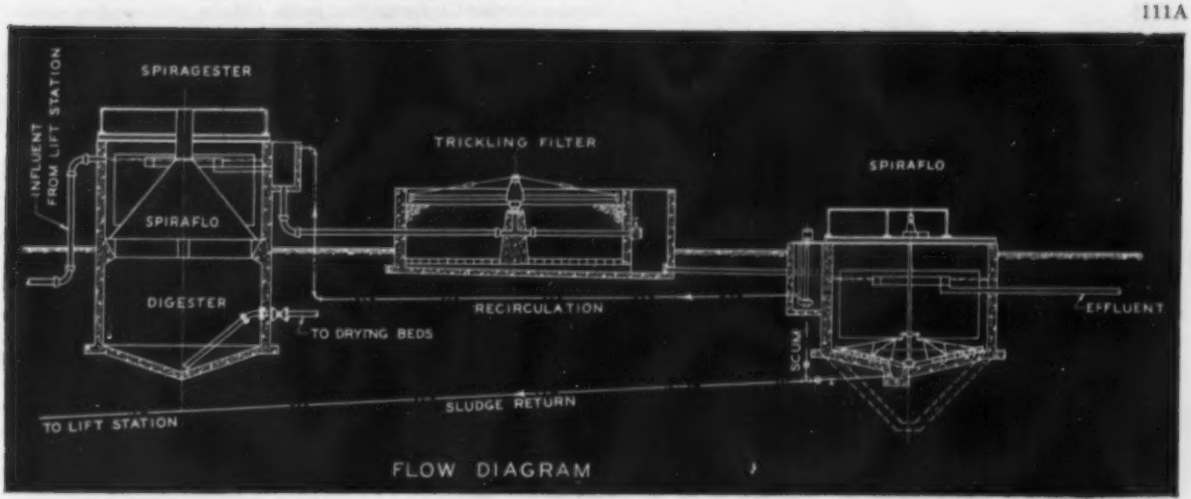
HOW YOU BENEFIT

- Greater efficiency and economy—greater reliability—are due to our licensees' special knowledge of local labor and materials resources. Most of them employ former Preload superintendents.
- Maintenance-free structures.
- Aesthetic virtues (possibilities of architectural treatment) unmatched in any other materials.
- A constant program of improvement in design and construction methods, available to all licensees.

PRELOAD through its own sales engineers or through its licensees is available for consultation. Technical data and literature available on request.

PRELOAD
TRADE MARK

THE PRELOAD COMPANY, Inc.
211 EAST 37th STREET
NEW YORK 16, N. Y.



FLOW DIAGRAM

YEOMANS
Spiragester

Combination clarifier and sludge digester—for primary and secondary treatment —is securing results like these:

45% Removal of B.O.D.—65% Removal of Suspended Solids—

100% Removal of Settleable Solids.

Solids removal is accomplished in the upper portion of the Spiragester by spiral downward flow of the influents introduced tangentially into an annular race, and enters clarification compartment at bottom. Diffusion is slow, uniform.

Settled solids in the clarification section enter the digestion compartment, mix actively with digesting material and are attacked by organisms which stabilize the sludge.

In the layout illustrated, secondary treatment is provided by a high capacity trickling filter and final sedimentation by a Spiraflo clarifier.

Ask for Typical Case History Performance Data. See your local Yeomans representative listed in the Yellow Pages of your telephone book under "Pumps," or write factory direct.

Yeomans Brothers Company, 1999-9 N. Ruby Street, Melrose Park, Illinois

Manufacturers of: Distributors • Clarifiers • Digesters • Mechanical Aerators • Pneumatic Sewage Ejectors • Centrifugal Pumps

The Cellular Waterstop, like other waterstops in the Water Seals line, is extruded from flexible long-lasting vinyl plastic, requires no form splitting, and is readily spliced in the field with a heated knife or soldering iron.

Small Engine Driven Electric Plants

719

D. W. Onan & Sons Inc., Minneapolis, Minn., has just announced a complete new line of small engine-driven electric generating plants ranging in size from 500 to 2,500 watts.

Entirely Onan-built, these new air-cooled, gasoline-operated electric plants are said to provide greater output at less weight and for lower cost.

The heavy-duty, 4-cycle engines, designed specifically for long-life generating plant service, will outlast and outperform general purpose engines used for the same application.

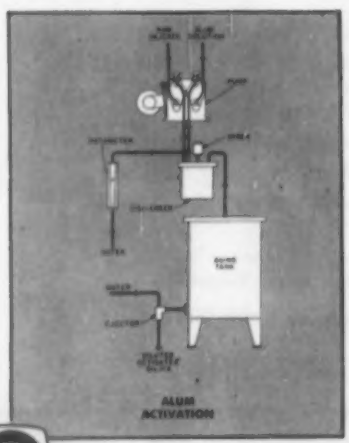
The new models are available in sizes of 500 and 750 watts, 60-cycle, A.C., for the AK Series and in 1,000 and 2,500 watts, 60-cycle, A.C. in the AJ Series. Battery charging units are available in sizes ranging from 500 to 1500 watts D.C.

ACTIVATED SILICA NEWS

SAFE ACTIVATION WITH ALUM

Continuous preparation of activated silica, a valuable coagulant aid, is now safe, sure, and simple with the Omega Activator and alum activation. Now you obtain activated silica without the problems and dangers of gas . . . and without the expense of special rooms or buildings for housing your activated silica feeding equipment.

Operational flexibility, positive interlock to prevent over-neutralization due to interruption of sodium silicate supply, and a special "visi-check" system for observing the activation process . . . these make the Omega Activator a most convenient unit to use. The Activator has been tested and proven in many important installations. *Bulletin 63-M1* gives complete details on all models — for activation by alum, chlorine, sulfuric acid, ammonium sulfate, or sodium bicarbonate. Write for your copy today. Omega Machine Co., 350 Harris Avenue, Providence 1, Rhode Island.



OMEGA THE LAST WORD IN FEEDERS

DIVISION OF B-I-F INDUSTRIES, INC.

BUILDERS IRON FOUNDRY • PROPORTIONEERS, INC. • BUILDERS-PROVIDENCE, INC.

METERS FEEDERS CONTROLS

Metallo-Plastic Sealing And Packing Compound

720

Surveys, Inc., Trenton, N. J., has available "Molyseal." Molyseal is a metallo-plastic sealing and packing compound, with Molybdenum Sulfide for use with steam, water, and air valves, expansion joints and pumps.

Molyseal is furnished in soft extruded "Plasticks" in ¼, 5/16, ⅜, and ½ inch diameters, packed in 5 lb. cartons. Installation is simple, old packing is removed, and Molyseal Plasticks are compressed into stuffing box, by gland takeup. Pressure generated in this operation, will induce cold-flow, and Molyseal will assume shape of stuffing box, filling it completely. Once Molyseal brushing has been formed, gland nut pressure is relieved, to allow for free torque.

Mechanical Link Between Proportioning Pumps And Motivating Equipment

721

Philadelphia Pump & Machinery Co., Philadelphia, Pa., has developed the "Philatrol," a patented mechanical link between proportioning pump and control motivating equipment—whether manual, hydraulic, pneumatic or electric—for the adjustment of piston stroke length and hence pump capacity while running, to accomplish accurate metering in relation to temperature flow, pH value, liquid level, pressure, conductivity or any other meterable factor.

Philatrol equipped Philadelphia Proportioning Pumps are said to be operating with an accuracy of plus or minus ½ percent over a range of a few cc. per hour to several gallons per minute.

Automatic Units to Monitor New Filtration Plant

722

Minneapolis-Honeywell Regulator Company, Philadelphia, Pa., has announced that a contract to build an automatic transmission system to monitor operations of a new $750,000 water filtration plant being built for Ogden, Utah, has been awarded to the company.

The control system, developed by the firm's Industrial Division engineers, will utilize a variety of pneumatic and electronic instruments to regulate flow, measurement, degree of

acidity and the filtering stages. The control system feeds into a centrally located master control panel which graphically portrays plant operation.

The concept of centralizing operation and control of a water treatment plant on a single master panel is believed to be unique. A maximum flexibility of supervision and control is provided from individual operating tables for each filter. Water treatment may be controlled from these individual tables or from the master Colorgrafic panel.

Factory Packaged pH System

722

The Beckman Division of Beckman Instruments, Inc., Fullerton, Calif., has just announced the availability of a "packaged" pH control system.

Designed for use in any pH process application, these systems combine in a single package all the components needed for single or multiple-channel pH process monitoring, recording and controlling. The entire system is built at the factory, wired, piped and assembled ready for plug-in installation. The basic components can be assembled into a number of different combinations.

BALDWIN ALUMINA SET

For quickly determining the residual alum in filtered water. The complete apparatus includes reagents, color standards and portable hardwood carrying case. The case protects the apparatus from possible contamination with alum dust. Complete with directions for use.

82-760 ..... Each $65.00

Write

Phipps & Bird, Inc.

6th & Byrd St., Richmond, Virginia

(2385 Rhode Island Ave., N.E., Washington, D. C.)

Life begins at forty

for steel pipe like this

THIS PICTURE WAS TAKEN IN 1915. Ever since, this 84-inch steel pipe has been an important part of Baltimore, Maryland's water system, distributing water from the Montebello Filtration Plant. It is protected against corrosion by Bitumastic Enamel.

This picture was taken forty years ago, right after this steel pipe had been hand-brushed with Bitumastic® Enamel. Thanks to this protection against corrosion, these mains are *still* an important part of Baltimore's water system. And the end of this pipe's useful service life is nowhere in sight.

A recent inspection bears out this statement. A group of water works engineers examined the 70-B Enamel Coating and reported it to be in excellent condition.

A 40-year record is good; but nowadays, even better records can be expected. Today, Bitumastic Enamel is applied *mechanically* to exterior and interior surfaces of pipelines, thus providing thicker protection, more uniform protection. And Bitumastic Enamels, themselves, are even better products.

Service records like this prove that it pays to use strong steel pipe, protected by Bitumastic Enamel. It's an economical combination for your large-diameter water lines. Write for full information.

SEWAGE EQUIPMENT PROTECTION!

Koppers also makes Bitumastic® Protective Coatings for all kinds of sewage-plant equipment. Give your expensive equipment the effective protection it deserves. Write for complete data.

KOPPERS

MADE ONLY BY KOPPERS

BITUMASTIC ENAMELS

KOPPERS COMPANY, INC., Tar Products Division

Dept. 761-T, Pittsburgh 19, Pennsylvania

DISTRICT OFFICES: BOSTON, CHICAGO, LOS ANGELES, NEW YORK, PITTSBURGH, AND WOODWARD, ALA.

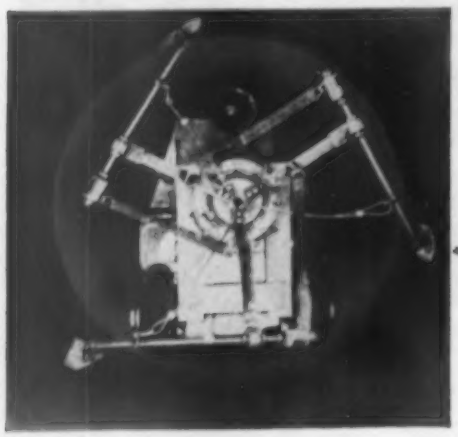
W&SW

Manufacturers' News

Graver Appoints New Representative

Graver Water Conditioning Co., New York, N.Y., has announced the appointment of the Atlas-Misrock Co. as Graver's new sales representative. The Atlas-Misrock Co., located at 110 North 8th Street, Richmond, Va., will handle Graver's complete line of industrial, municipal and industrial waste treatment equipment. Their territory will include the states of Virginia, Maryland and the southern part of Delaware.

Mr. A. Misrock will be the engineering representative handling Graver's equipment. He has many years of extensive experience in the water and liquid treatment fields.



CENTRILINE goes to CUBA

The Centriline process has been selected by Municipio de la Habana to play an integral part in the expansion of this city's water supply system. Over 114,000 feet of new welded steel pipe, ranging in diameters from 30" to 78", will be cement-mortar lined in the near future.

In this process, the novel machine illustrated above is drawn through the pipe while cement-mortar is centrifugally sprayed on the pipe walls and troweled smooth by the rotating arms. Mortar thickness is controlled by the speed of the entire machine. Because the pipes remain in place throughout the process, traffic interruption is cut to a minimum; time and money are saved.

Whether you're expanding or rejuvenating your water system, follow the lead of progressive city officials and engineers around the world. Call on Centriline to add years of new life to your water supply lines.

Supervising engineer on the project is Francisco Pividal, C. E.; Chief Engineer is Adrian Macia, C. E.; General Contractor: Comp. Constructora M. A. Gonzales del Valle, S. A.; Pipe Contractor & Manufacturer: Tuberia de Concreto Universal, S. A.

CENTRILINE CORPORATION

A subsidiary of the Raymond Concrete Pile Company

140 CEDAR STREET
NEW YORK 4, N. Y.

Branch Offices in Principal Cities of the United States and Latin America

• CEMENT-MORTAR LINING OF PIPES IN PLACE •

Milo Smith Retires From Chicago Bridge

The Chicago Bridge & Iron Company, Chicago, Ill., has announced the retirement of Milo E. Smith on July 1st, 1955.

Mr. Smith joined the company on July 1st, 1923, and served as Advertising Manager from January 1st, 1926, to July 20th, 1954.

Active in the Chicago Industrial Advertisers Association for thirty years, Mr. Smith served as President of that organization in 1934-1935 and was elected a Life Member in October, 1954. He also served on committees, as a Director, and as a Vice President of the National Industrial Advertisers Association in the early days of that organization.

Steinwender Appointed Permutit Vice President

The Permutit Company, New York, N. Y., has announced that Sheller L. Steinwender has been appointed Vice President.

Before joining The Permutit Company, Mr. Steinwender, a Chemical Engineer, was Vice President of the Scaife Company in Pittsburgh, Pa. Prior to that, he was with the A. O. Smith Corporation and the American Cyanamid Company.

Bash Joins Carlon as Sewer And Drain Pipe Consultant

Carlon Products Corp., Cleveland, Ohio, has announced that Carl J. Bash, two-term president of the American Society of Sanitary Engineering, has joined the company to serve as management consultant on specifications and standards for the

(Continued on page 116A)

Do you have a waste-treatment problem?

...If you do, you'll want this book

Here's the story of a new highly efficient flotation system that may well solve your problem... whether you're removing suspended solids from waste liquids...or recovering valuable materials from process liquids.

Bulletin No. 54-82 describes the unique new Rex Float-Treat System...a process employing millions of minute air bubbles to remove suspended matter by flotation efficiently and economically. The Rex Float-Treat System is a packaged unit based on sound, time-proven hydraulic principles...adaptable to either concrete or steel tank construction. The informative bulletin shows typical Float-Treat Systems for a number of different applications...covers the many advantages in both cost and results...indicates what the Float-Treat System will do.

For your copy of this valuable, informative booklet on the new Float-Treat System, mail the coupon.

REX FLOAT-TREAT Equipment is licensed to practice U. S. Letters Patent of F. S. Gibbs, Inc.

REX®

CHAIN BELT COMPANY

MILWAUKEE 1, WISCONSIN

CHAIN Belt Company
4610 W. Greenfield Ave.
Milwaukee 1, Wisconsin

55-203

Send me my copy of the informative Bulletin 54-82 on the new Float-Treat System.

Name.....

Address.....

Title.....

City.....*Zone*.....*State*.....

new Carlon "D" sewer and drain pipe.

Mr. Bash will work with municipal, state and federal boards in an educational capacity regarding uses of the new pipe. His board experience in sanitary engineering includes 11 years with the City of Cleveland as chief plumbing inspector.

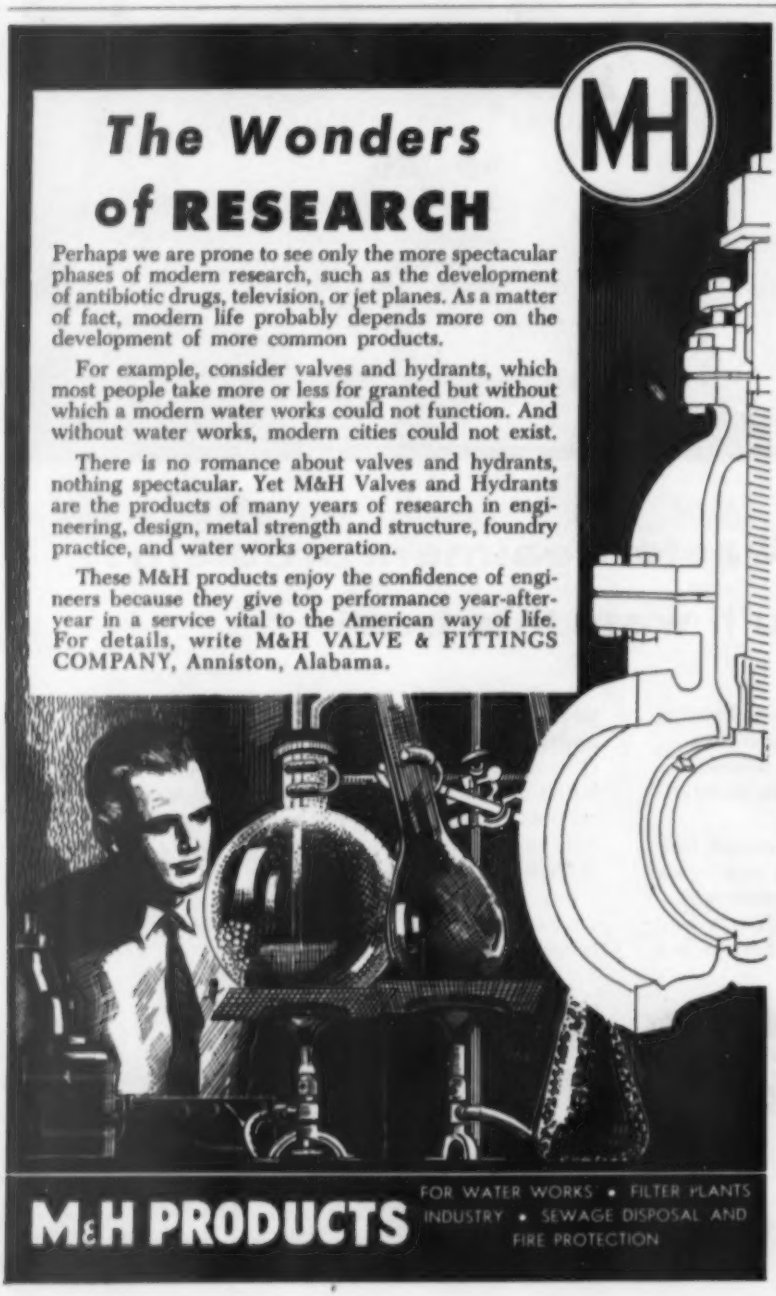
Stevenson Named A-C President

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has announced that Robert S. Stevenson, executive vice president since 1952, has been elected president.

Stevenson succeeds the late William A. Roberts, who died April 12.

Stevenson started with Allis-Chalmers in 1933 as a salesman in the Kansas City branch office of the tractor division, transferring to the company's headquarters in Milwaukee in 1936. In 1948, he was appointed assistant general sales manager for the tractor division and two years later he was named general sales manager.

Stevenson was appointed vice president in charge of the tractor division in February, 1951, succeeding the late W. A. Roberts, who was elected president at that time. Later in 1951 Stevenson was elected to the Allis-Chalmers board of directors. In July, 1952, Stevenson was appointed executive vice president of Allis-Chalmers. He is also a member of the executive committee of the board of directors.


The Wonders of RESEARCH
Perhaps we are prone to see only the more spectacular phases of modern research, such as the development of antibiotic drugs, television, or jet planes. As a matter of fact, modern life probably depends more on the development of more common products.
For example, consider valves and hydrants, which most people take more or less for granted but without which a modern water works could not function. And without water works, modern cities could not exist.
There is no romance about valves and hydrants, nothing spectacular. Yet M&H Valves and Hydrants are the products of many years of research in engineering, design, metal strength and structure, foundry practice, and water works operation.
These M&H products enjoy the confidence of engineers because they give top performance year-after-year in a service vital to the American way of life. For details, write M&H VALVE & FITTINGS COMPANY, Anniston, Alabama.
M&H PRODUCTS
FOR WATER WORKS • FILTER PLANTS INDUSTRY • SEWAGE DISPOSAL AND FIRE PROTECTION

Hays Corp. Promotes Riggs

The Hays Corporation, Michigan City, Indiana, has announced the election of Orval W. Riggs to the position of Vice President in charge of Sales, and the appointment of Louis E. Hapke to the position of Controller.

Mr. Riggs, a graduate in electrical engineering from Purdue, joined the company in 1934. He has served as a project engineer, Chief Project Engineer, and for the past two years as Sales Manager.

Executive Changes At Bailey Meter

Bailey Meter Company, Cleveland, Ohio, has announced the following changes in top management:

Paul S. Dickey, former vice president and a director of the company, has been elected president succeeding Robert S. Coffin, who was elected chairman of the executive committee and named management consultant. Coffin, with the company since its establishment in 1916, had been president since 1944.

Harvard H. Gorrie, chief engineer, has been elected a vice president in charge of all engineering activities, and Raymond D. Junkins, head of the patent department, has been elected a vice president and director. H. M. Hammond continues as a director and vice president in charge of all sales activities.

American Locomotive Co. Changes Name

American Locomotive Company, Schenectady, N. Y., has announced a change in the name of the 118-year old concern to Alco Products, Incorporated. The new name has been adopted to reflect the company's increasingly diversified operations which have grown beyond its role as a leading locomotive supplier.

The company has been in continuous operation since 1837, when the Rogers Locomotive Works of Paterson, N. J., produced its first

locomotive. Rogers was one of eight predecessor companies which combined to form American Locomotive in 1901.

While locomotive production will continue to be a major operation, ALCO today manufactures products for more than a dozen principal markets. Over three-quarter's of the company's 1954 output of regular products was in new lines.

Fairbanks-Morse Opens Eastern Sales and Service Headquarters

Fairbanks, Morse & Co., Chicago, Ill., has announced the opening, at Fair Lawn, N. J., of a new sales and service headquarters for a seven-state area including Connecticut, New York, New Jersey, Eastern Pennsylvania, Maryland, Delaware and Virginia. The company's Export Division sales offices also are located in the new headquarters building.

Purpose of the new facilities is to improve service to both domestic and export customers. The 50,000 sq. ft. building on a five and a half acre plot serves as a central shipping point for a wide variety of company products which will be stocked in the ample warehouse, permitting quicker shipment of stock products.

Peerless Pump Promotes Nickel and Olson

Peerless Pump Division, Food Machinery and Chemical Corporation, Los Angeles, Calif, has announced the appointments of Carl L. Nickel as product sales manager, water systems and dealer line products, and the appointment of Norman C. Olson as product sales manager, engineered line products.

Both Nickel and Olson have been with FMC's Peerless Pump Division since 1946. Nickel was previously a product sales manager and Olson was previously branch manager of the firm's Chicago office.

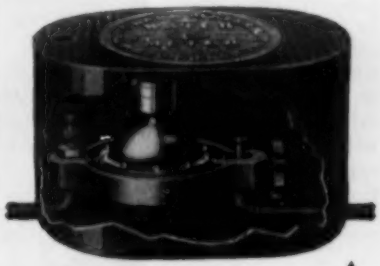
Howell Appointed By Sterling Motors

Sterling Electric Motors, Inc., Los Angeles, has announced that John R. Howell has been appointed Vice President in Charge of Sales. Howell has been with Sterling for 27 years, serving as

(Continued on page 118A)

CLARK METER BOXES AND COVERS
OF CAST IRON

Left, No. 16 Clark Wonder Lock Meter Box Round....16" and 18" diameters. Large 13" lid.



Above, No. 11 Oval Clark Wonder Lock Meter Box, especially for warmer climates. H-11", L-18", W-12".

Below, A-2-13 Clark Meter Box Cover with screw lock. Height 4", lid opening 13".

Above, A-2-11 Clark Single Lid Meter Box Cover, 4" throat. Also available in 6" and 9" throat.

Below, B-2-11-L Clark Double Lid Meter Box Cover, 6" throat. Also available in 4" and 9" throat.

Above, AA-3-12 Clark Meter Box Cover with 13" Wonder Lock Lid, for use with 15" (illustrated), 18" and 20" box body.

Improved Screw Lock with strong forged bronze bolt.

Wonder Lock Lid (bottom view) showing forged bronze bars.

Perfect Lock of one-piece manganese bronze forging.

Write

H. W. CLARK CO.
MATTOON, ILLINOIS

sales manager since July, 1954, and for six years prior to that time as assistant sales manager. Mr. Howell is a graduate of the California Institute of Technology.

Sales Appointments at Foxboro

The Foxboro Company, Foxboro, Mass., has announced the appointments of Mr. C. C. Fuller as vice president, augmenting the sales management staff, Mr. H. O. Ehrisman as general sales manager, and Mr. J. J. Burnett as field sales manager. Mr. C. Schwarzler will continue to direct Foxboro's expanding international operations. Vice president C. E. Sullivan, who has retired from active sales direction, will serve in a consulting capacity with the sales organization.

Also announced was the formation of a sales product development committee headed by Mr. Fuller and a sales policy committee with Mr. Ehrisman as chairman, further coordinating the company's sales engineering and manufacturing functions.

W&T Promotes Brigham and Demler

Wallace & Tiernan Incorporated, Belleville, N. J., has announced the appointment of Mr. J. C. Brigham as Chief Engineer for the company. Mr. Brigham has been associated with Wallace & Tiernan since shortly after his graduation from Cornell University in 1935.

Prior to his new appointment Mr. Brigham was connected with the company's development department and most recently with the Wallace & Tiernan sales organization as Manager of the Division of Technical Services.

Mr. L. E. Demler has been appointed as Manager of the Division of Technical Services. Prior to his promotion, Mr. Demler was Manager of the Wallace & Tiernan Chemical Feeder Department. He was responsible for the sale of the company's line of chemical feeding equipment as well as automatic weighing scales for water works and industrial use.

Bulkley, Dunton Announces New Representative

Bulkley, Dunton Processes, Inc., New York City, N. Y., has announced the appointment of Paul S. Cooper of Westport, Conn., to handle the complete line of Bulkley, Dunton equipment.

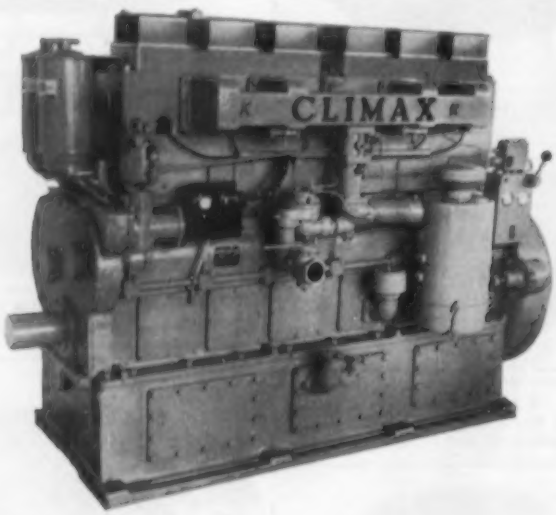
According to the company, Cooper will serve all industries in Connecticut, Massachusetts, Rhode Island, Vermont, New Hampshire and Maine.

Sales Personnel Changes At Fairbanks-Morse

Fairbanks, Morse & Co., Chicago, Ill., has announced the appointment of John C. Elmburg, formerly Manager of the company's Portland, Oregon, Branch, as Assistant General Sales Manager effective July 1st.

Mr. Elmburg is well qualified for his new position as he has, during the past twenty-six years with the company, served as Technical Assistant, Field Engineer, Department Manager and Manager of the firm's Boston, Atlanta and Portland Branches.

Mr. Elmburg is succeeded by William F. Wahlenmaier as Portland Branch Manager who joined the company in 1939 as a technical assistant in the Pump and Electrical Department of that sales office. Since 1954 he has been Electrical Department Manager, which position he held until his recent advancement.



AN ENVIABLE REPUTATION

Climax sewage gas engines have established a reputation for economy, dependable operation and low maintenance cost, in more than 70 Sewage Treatment Plants from coast to coast.

The late model 6 cylinder, in-line engine pictured here portrays the modern design which, coupled with conservative ratings, moderate speeds and carefully engineered installations, is the basis for this reputation.

The tremendous savings to be made from the use of sewage gas for power and the utilization of heat from jacket water and exhaust for buildings and digestors, make the choice of Climax engines exceedingly desirable.

climax

FOR COMPLETE INFORMATION, WRITE TO . . .

ENGINE AND PUMP MFG. CO.

208 So. La Salle St.

CHICAGO 4, ILLINOIS

Factory—Clinton, Ia. *District Office*—Dallas, Tex.

Literature & Catalogs

Measuring And Controlling Liquid Level

723

Minneapolis-Honeywell Regulator Company, Industrial Division, Philadelphia, Penn., has available a bulletin on **Measuring and Controlling Liquid Level.**

The bulletin includes a discussion of the basic principles of liquid level measurement, control and transmission. Systems are described in detail along with the applications, principles of operation, limitations and advantages of each.

Vertical Pumps

724

Peerless Pump Div., Food Machinery & Chemical Corp., Los Angeles, Calif., has just released a 16-page bulletin on **Vertical Industrial Service Pumps.**

The bulletin describes and illustrates the application of Peerless vertical industrial service pumps for liquid transfer from short settings in both industrial and process services.

Two pages of the bulletin cover design recommendations for obtaining optimum performance from close-coupled pumps installed in sumps. The bulletin is illustrated with engineering diagrams of three types of pumps and installation photographs show these pumps in a wide variety of services.

Centrifugal Pumps

725

Aurora Pump Division, New York Air Brake Co., Aurora, Illinois, has just issued an 8-page bulletin describing Aurora's **Type O Horizontal Split Case, Double Suction Centrifugal Pumps.**

According to the bulletin, these pumps are recommended for municipal and industrial water supply or for handling circulating and wash water, chemical solutions and

(Continued on page 120A)

125# Valves...drop tight!

Will not "freeze" from corrosion— *Corrosion can't hinder operation.* Disc edges are chrome plated or stainless steel and close into a thick rubber seat. These features plus self lubricated bearings and stainless steel shafting make it impossible for valves to "corrode tight" either open or shut.

Full 90° closure into Rubber Seat— The disc is slightly larger than the inside of the rubber seat and thus actually displaces the rubber when closed. The ratio of seat thickness to disc indentation insures drop-tight shut off and avoids permanent set. The seats are secured in the valve body by removable keeper segments.

Saves space. Even these high pressure valves are compact, easy to install, and require little head room. Available from 10" to 72" diameter in either cast iron or fabricated steel. A variety of operator types can be supplied.

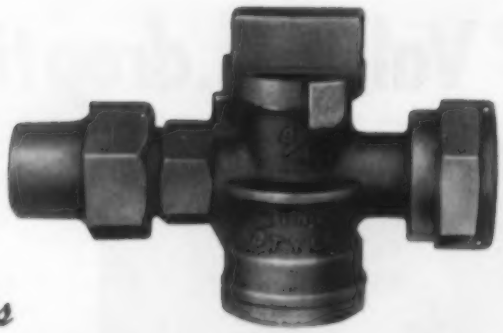
WRITE FOR COMPLETE DETAILS:
"UNDERSTANDING THE BUTTERFLY VALVE" . . BULLETIN 2C
LOW PRESSURE VALVES . . BULLETIN 1C
HIGH PRESSURE VALVES . . BULLETIN 4C

HENRY PRATT

RUBBER SEAT
Butterfly Valves

Henry Pratt Company, 2222 S. Halsted St., Chicago 8, Ill. Representatives in principal cities

• If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.



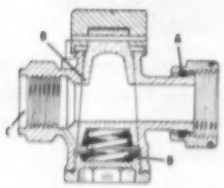
This

METER VALVE

Saves installation costs where space is limited

Permitting "in-line" setting of meters in tight space, the Ford Straight Ringstyle Valve also saves fitting labor and at least one coupling.

This valve enjoys all of the advantages of the famous Ford Angle Ringstyle valve. Note these features: (A) Ringstyle coupling that eliminates a pipe joint as well as a coupling (B) Recessed key that keeps deposits from damaging valve surfaces (C) "Set-in" threads to protect threads of iron pipe and (D) Bronze spring that keeps key in place. No leather gasket required, prolonging valve life.



For full information, ask for Catalog that also contains details on many other meter-setting products for economy minded utilities.

THE FORD METER BOX COMPANY, INC.

FOR BETTER WATER SERVICES FORD

Wabash, Indiana

HYDRO-TITE

DEPENDABLE JOINTING COMPOUND

Seals Bell and Spigot Water Mains

Economical—Effective

Over 35 Years Of Dependable Performance

HYDRAULIC DEVELOPMENT CORP.

***MAIN SALES OFFICE* 50 CHURCH ST., N. Y. C.**

General offices and works W. Medford Sta., Boston, Mass.

oils, and are supplied in capacities to 4,600 gpm against heads up to 225 feet.

The bulletin describes the construction details and includes suggested specifications, a dimension chart and a selection table showing range of output and heads. Cutaway views with parts lists illustrate the three types which comprise the series. Photographs illustrate typical applications.

Swimming Pool Equipment

726

Graver Water Conditioning Company, New York, N. Y., has available a bulletin on **Swimming Pool Equipment** and accessories that will be of interest to all pool operators, designers, engineers, city officials and private pool owners.

The bulletin illustrates many indoor and outdoor pools and their equipment, describes modern filtering and recirculating equipment and accessories, and includes typical drawings of the systems.

Descriptions of the accessory equipment are included with the advantages for using each type.

Cathodic Protection Reprints

727

Corrosion Rectifying Company, Houston, Texas, has available a series of technical reprints on **Cathodic Protection** and how it works against corrosion.

The articles include detailed information about how the problem of external corrosion of flow lines laid in salt water and moist land was solved and how the lines were given complete protection. The economics of cathodic protection are covered in a dollars and cents comparison between protection and non-protection in another of the articles.

Parallel Shaft Gear Drives

728

Link-Belt Company, Chicago, Ill., has just published a catalog describing the company's complete line of **Parallel Shaft Gear Drives.**

Listed in the catalog are 39 standard size single, double and triple reduction drives, permitting a standard ratio selection from as small as 1.2:1 to 323:1, with horse-

power capacities of over 2,000.

This book also contains complete engineering data, including simplified horsepower tables, dimensions, and overhung load capacities for selection from the standard line. Baseplates and built-in backstops are also covered.

Zeolite Water Softeners

729

The Permutit Company, New York, N. Y., has released a bulletin on **Permutit Water Softeners.**

The 20-page bulletin thoroughly discusses the troubles caused by the utilization of hard water and the multiple economies effected by curing them.

The bulletin lists several industries where steam and water are of importance and should be of interest to all engineers dealing with water problems. Specifications, operating characteristics and typical installation photographs have been included in this revised edition.

Multi-Function Control System

730

Builders-Providence, Inc., Providence, R. I., has just released a color bulletin on an economical multi-function control system, called **Synchro-Scan Supervisory Control.**

According to the bulletin, this control system features unique "plug-in" units of "building Block" construction, which permit low cost system expansion when the need arises.

The bulletin also contains an abundance of photos of individual components and shows pictorially, a complete typical supervisory control system. In addition detailed sections on description, advantages and operation are included.

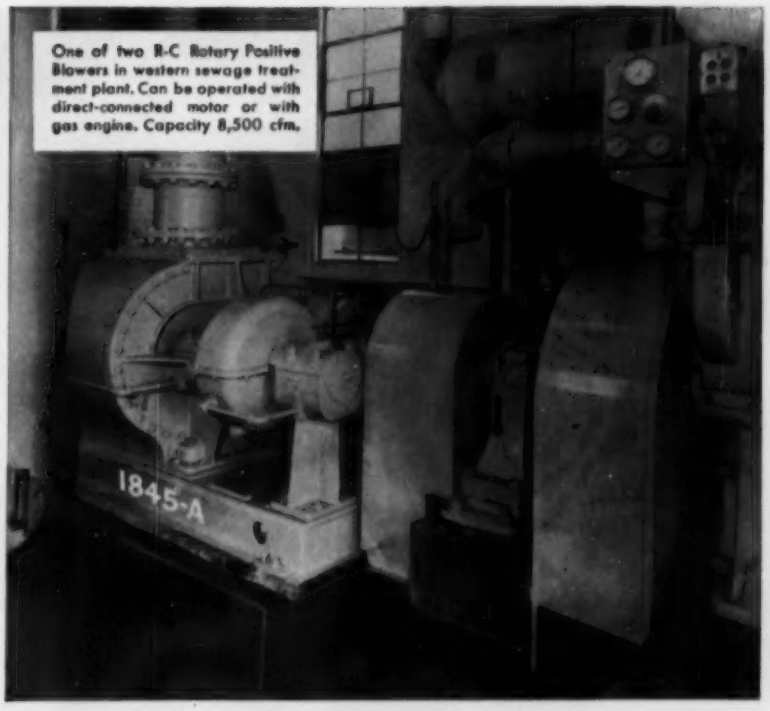
Strainer Bulletin

731

S. P. Kinney Engineers, Inc., Carnegie, Pa., has just released a 13-page bulletin on **Strainers.**

The well illustrated bulletin contains descriptions, dimensions, capacities, installations and pertinent engineering information on the strainers. Those discussed in detail are: Models A and K automatic self-cleaning strainers; the

(Continued on page 124A)



One of two R-C Rotary Positive Blowers in western sewage treatment plant. Can be operated with direct-connected motor or with gas engine. Capacity 8,500 cfm.

You can have DRIVE FLEXIBILITY with R-C BLOWERS

CHECK THE "BIG 4" ESSENTIALS

1. Accurate volume at required pressure
2. High efficiency—low operating cost
3. Low maintenance cost —low down time
4. Freedom from oil or oil vapor contamination

Check your present blowers and if they don't measure up, it may be an economy to replace them with modern R-C equipment.

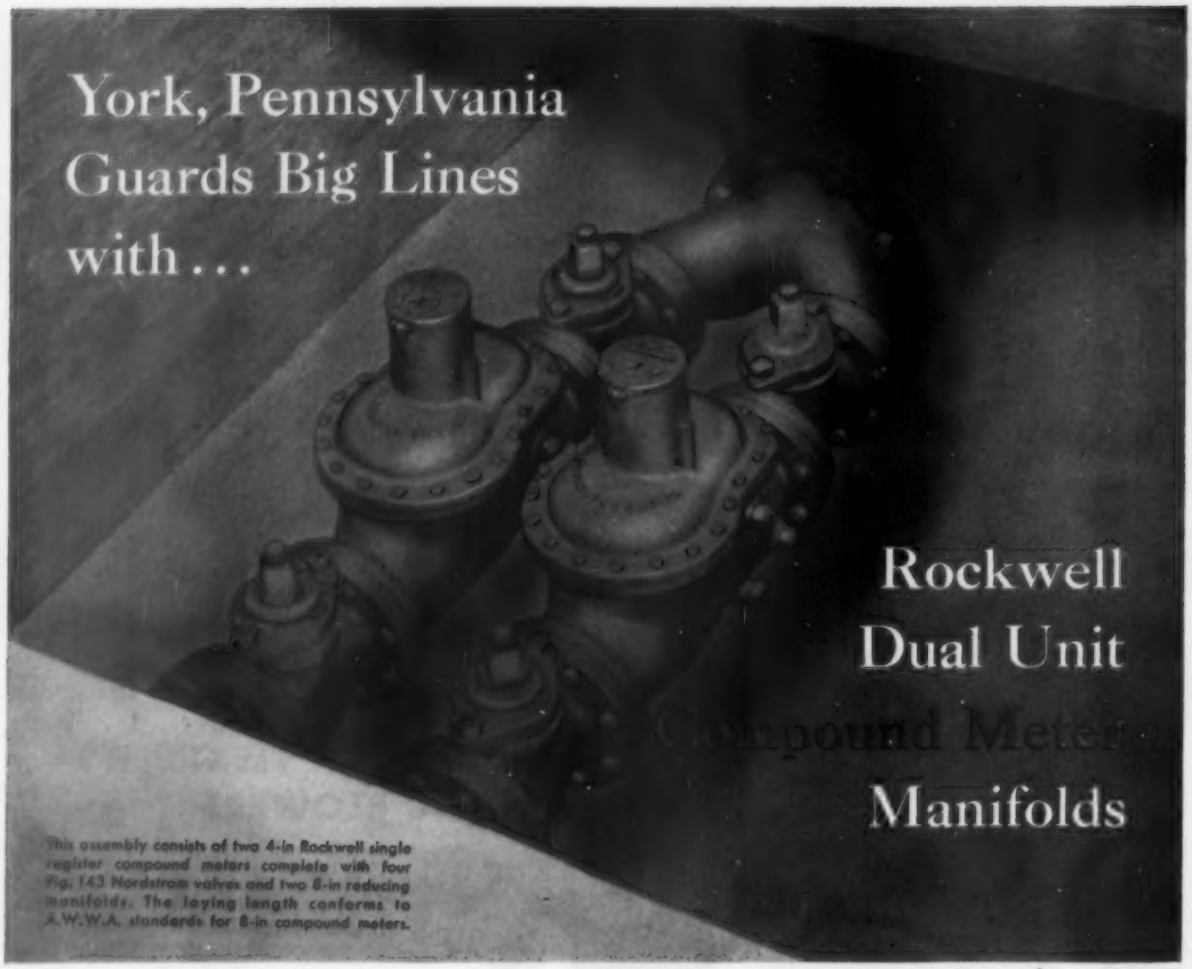
In addition to the "BIG 4" advantages of Roots-Connersville Blowers for sewage treatment, another important factor is their adaptability to any modern drive. In the installation pictured, the plant manager can change at will from direct connected motor drive to gas engines, for greater operating economy when gas is available.

With capacities from 5 cfm to 50,000, R-C Rotary Positive equipment is used by more sewage treatment plants than any other make. Further, engineers can choose from the exclusive R-C *dual-ability* line either Rotary Positives or Centrifugal units (from 2,000 cfm to 100,000 cfm or higher) to match their specific needs.

Thus, in types, capacities and drives, R-C Blowers permit exact selection to the requirements of any plant, large or small. Ask for counsel and suggestions for new installations or replacements, or send for details in bulletin RB-154 on Rotary Positive and bulletin 120-B-14 on Centrifugal equipment.

ROOTS-CONNERSVILLE BLOWER

A DIVISION OF DRESSER INDUSTRIES, INC.
755 Mount Ave. • Connersville, Indiana
Roots-Connersville Blower (Canada) Ltd. • 629 Adelaide St. W., Toronto, Ont.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Manifolds
This assembly consists of two 4-in Rockwell single register compound meters complete with four Fig. 143 Nordstrom valves and two 8-in reducing manifolds. The laying length conforms to A.W.W.A. standards for 8-in compound meters.

Sure Way To Avoid Shutdowns

Big compound meters are one of your most important sources of revenue. But big compounds are often sluggish—always difficult to install and service. To ease this burden, install two meter Rockwell manifold units. They *measure all the flows* with greater accuracy. Uninterrupted service is assured since either meter can be used to record off-peak loads while a new or repaired meter is being installed in the other branch of the manifold. What's the initial cost for all this accuracy and convenience? Usually less than for a single big meter. Write for full details.

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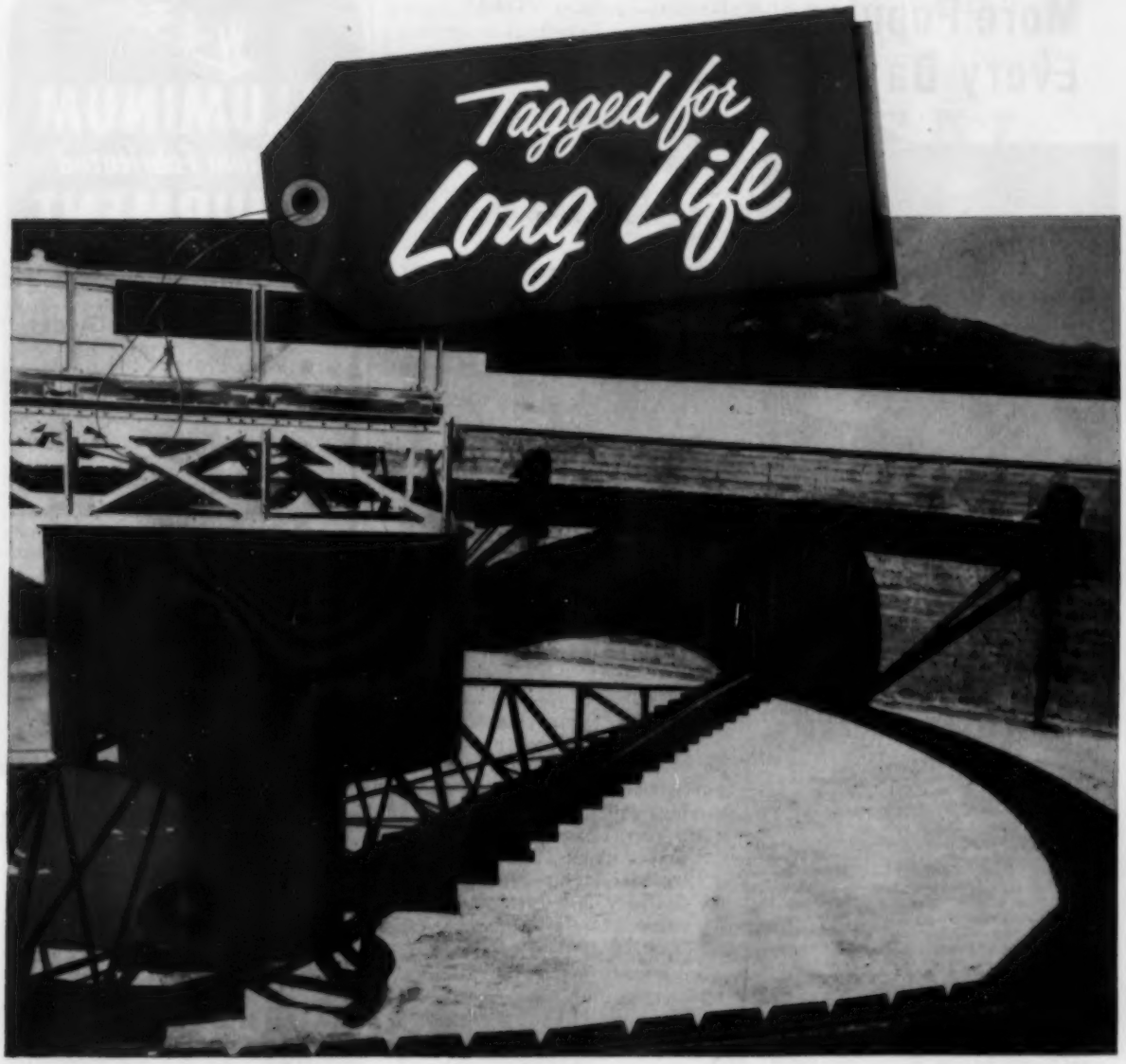

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Pitt Chem Tar Base Coatings outlast ordinary paints by many times. Yet they cost no more per gallon. They are easy and economical to apply and form a tight, lasting bond with metal, masonry, concrete and stone.

Here's the story in a nutshell: *No other material does such a complete job of protection at so little cost.* If you want to stop water sewage corrosion—and reduce costs in the bargain—call for a Pitt Chem corrosion engineer today to survey your specific problems. A call, wire or letter will place him at your service.

W&D 5456

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During 1954 more Leopold duplex filter bottoms were sold than in any previous year in our history. To date, there are well over 300 plants (with a daily capacity in excess of 1¾ billion gallons) that have selected Leopold bottoms—including such major municipal installations as Phoenix, Arizona; Houston, Texas; Trenton, New Jersey; Detroit, Michigan; Baltimore, Maryland; Columbus, Ohio; Kansas City, Missouri; Omaha Nebraska; and Philadelphia, Pennsylvania. Represented in this group are the five largest municipal filter plants under construction in the country at this time.

There are, of course, good reasons why the Leopold Glazed Tile Filter Bottom is getting more popular every day. In this design, laterals and distributing blocks are combined in one permanent unit that insures equal distribution and uniform filtration. The individual blocks are made of de-aired fire clay, vitrified and salt glazed. They resist corrosion, are not subject to tuberculation, won't absorb any detrimental amount of water, are impervious to acids and alkalis, and will last indefinitely.

If you're looking for a practical, economical solution to your underdrain problems, consider the advantages offered by Leopold. We'll be glad to supply details—without obligation.

Look to Leopold for complete water purification and sewage plant equipment...

• Dry Chemical Feeders • Mixing Equipment
• Filter Operating Tables • Filter Bottoms

Write today for details

F. B. Leopold Co., Inc.
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Pittsburgh 4, Pa.

manually-operated self-cleaning strainer; the twin basket strainer; and the twin basket self-cleaning strainer.

According to the bulletin, these strainers will remove fine suspended particles from raw or process water, oil, gasoline, white water, and many other liquids. Pipeline sizes range from 2 to 48 inches.

Automatic Control of Variable Speeds

732

U. S. Electrical Motors, Inc., Los Angeles, Calif., has just published a full-color, 8-page bulletin on **Automation Through Varitrol Control.**

Multi-color cross-sections and diaphanous views show how an improved pneumatic control called Varitrol has been designed into U. S. Varidrive Motors to increase and improve output.

An interesting dimensional schematic drawing shows the Varitrol as a pneumatic amplifier composed of a "power" system and a "signal" system. Color photos explain how the use of the Varitrol in connection with U. S. Varidrive Motors provides sensitive and stable automatic control which permits the Varidrive speed to be controlled by pressure, temperature, humidity, viscosity, flow rate, liquid level, pH value, etc.

Typical automatic control applications are shown. Schematic drawings explaining the process are shown with each application.

Steel Grating and Treads Catalog

733

Blaw-Knox Company, Pittsburgh, Pennsylvania, has just released a 16-page catalog on Electro-

Manufacturers Representative

For leading Eastern manufacturer of nationally advertised line of plug, relief and high pressure service valves, meter connections, pipe tapping machines, etc., to contact any one or all of the following: gas utilities, water works, plumbing, heating and industrial supply houses. Straight commission. Partially established, protected exclusive territories open. Reply to E. S. Boyer, Director of Sales, Welsbach Corporation, Kitson Valve Division, Philadelphia 29, Pa.

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For steel, cast iron and Transite pipe. Single massive bolt. Sizes 1" to 12" inclusive. Write for catalog.

M. B. SKINNER COMPANY
SOUTH BEND 21, INDIANA

forged Steel Grating and Treads.

Amply illustrated with photographs and drawings, the catalog describes the types, sizes and load characteristics of the complete line of electroforged steel and interlocked aluminum grating manufactured by the company.

Unique Flow Diagrams For Water Treatment

734

Graver Water Conditioning Co., New York, N. Y., announces the availability of new, **Permanent Flow Diagrams** designed to increase operating convenience of water treatment equipment. These diagrams are made of specially laminated durable plastic, can be easily cleaned and will maintain their appearance indefinitely. The flow diagram, which can incorporate a complete layout of equipment, is reproduced on the plastic by a photographic process.

Mounted near the central control for easy accessibility, it will give the operator a quick, complete picture of equipment operation and will spot any valves not centrally located. Easily removable notations or instructions can be made on the diagram with marking pencil.

Since Graver installations are tailor-made to individual needs each diagram must be separately designed.

Totally-Enclosed and Explosion-Proof Motors

735

U. S. Electrical Motors Inc., Los Angeles, Calif., has just published a bulletin describing a new series of **U. S. Totally-Enclosed and Explosion-Proof Motors.**

(Continued on page 126A)

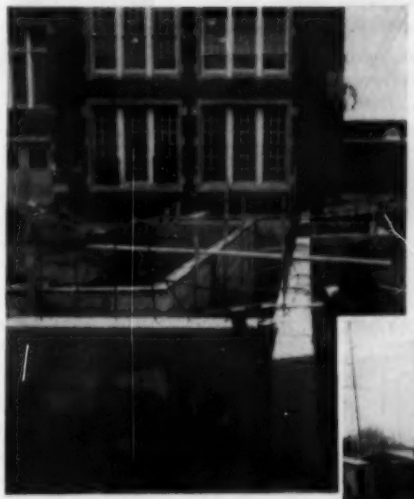
WANTED

Manufacturers Representatives for nationally advertised, well-known line of Butterfly and Slide Valves, to contact water works, sewage works, gas and electric utilities, industrial users.

Territories open in Florida, Georgia, Louisiana, Arkansas. Write to H. A. Clouet, W. S. Rockwell, 200 Eliot St., Fairfield, Conn.

How to make a school foundation
water repellent, sturdy and *long lasting*

THOROSEAL
Foundation Coating



Correct procedure is shown here, where foundation is given 2 brush coats of THOROSEAL Foundation Coating, immediately after construction forms are removed.

Poured concrete exterior walls and tunnel walls, 2 coats of Foundation Coating, and inside concrete block walls, 2 coats of THOROSEAL

Bagley School
Pontiac, Michigan
Architect—William Zimmerman
Contractor—Nolan Gottschall

NO MAINTENANCE COST HERE!

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Get our pictorially described literature
"HOW TO DO IT"
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. . . give these outstanding plants—corrosion free construction • uniform flow distribution • low head loss.

CLEVELAND, OHIO (Havens & Emerson, Engrs.)
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MIAMI, FLA. (Day & Zimmerman, Inc., Engrs.)
WILMINGTON, DEL. (Metcalf & Eddy, Engrs.)

For details on monolithic and pre-cast Wheeler Bottoms, write Builders-Providence, Inc., 350 Harris Avenue, Providence 1, Rhode Island.

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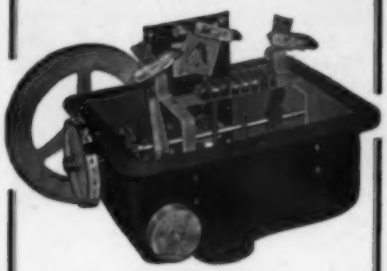
DIVISION OF B-I-F INDUSTRIES, INC.
BUILDERS IRON FOUNDRY • PROPORTIONERS, INC. • OMEGA MACHINE CO.
METERS FEEDERS CONTROLS

ROTO-TROL



RF-2

WITH ALTO-TROL

This 2-pump RF-2 Roto-Trol assures equal use and wear of both pumps. Each pump is operated on alternate starting cycles. The RF-2 operates both pumps together, when required. RF-2 installations give dependable service year after year, with the minimum of attention.

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Please send FREE copy of "Planned Protection"—complete manual on property protection.
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CONTINENTAL
STEEL CORPORATION • KOKOMO, INDIANA

A colored cross-section of the U. S. type J motor with fan is shown with call-outs pointing out the many construction benefits. Photographs and drawings graphically illustrate such features as the pre-wound stator core, asbestos-protected windings, and Lubriflush lubrication.

Sewage and Waste Odor Control

736

Airkem, Inc., New York, N. Y., has available a folder on **The Effective Reduction of Sewage and Waste Odors.**

This attractive 4-page, 2-color, folder, by means of photographs and descriptive text gives 6 case histories where an Airkem installation successfully overcame malodors at sewage plants and open trench fills. A complete list of Airkem distributors and a discussion about the advantages of an Airkem installation are given on the back page.

WANTED: ASS'T TRAFFIC ENGR.

For traffic engineering department just recently established. Salary range $537 to $620 a month with maximum salary obtainable through annual and longevity increases. Registration as a professional engineer required. Applications accepted until the needs of the service are filled.

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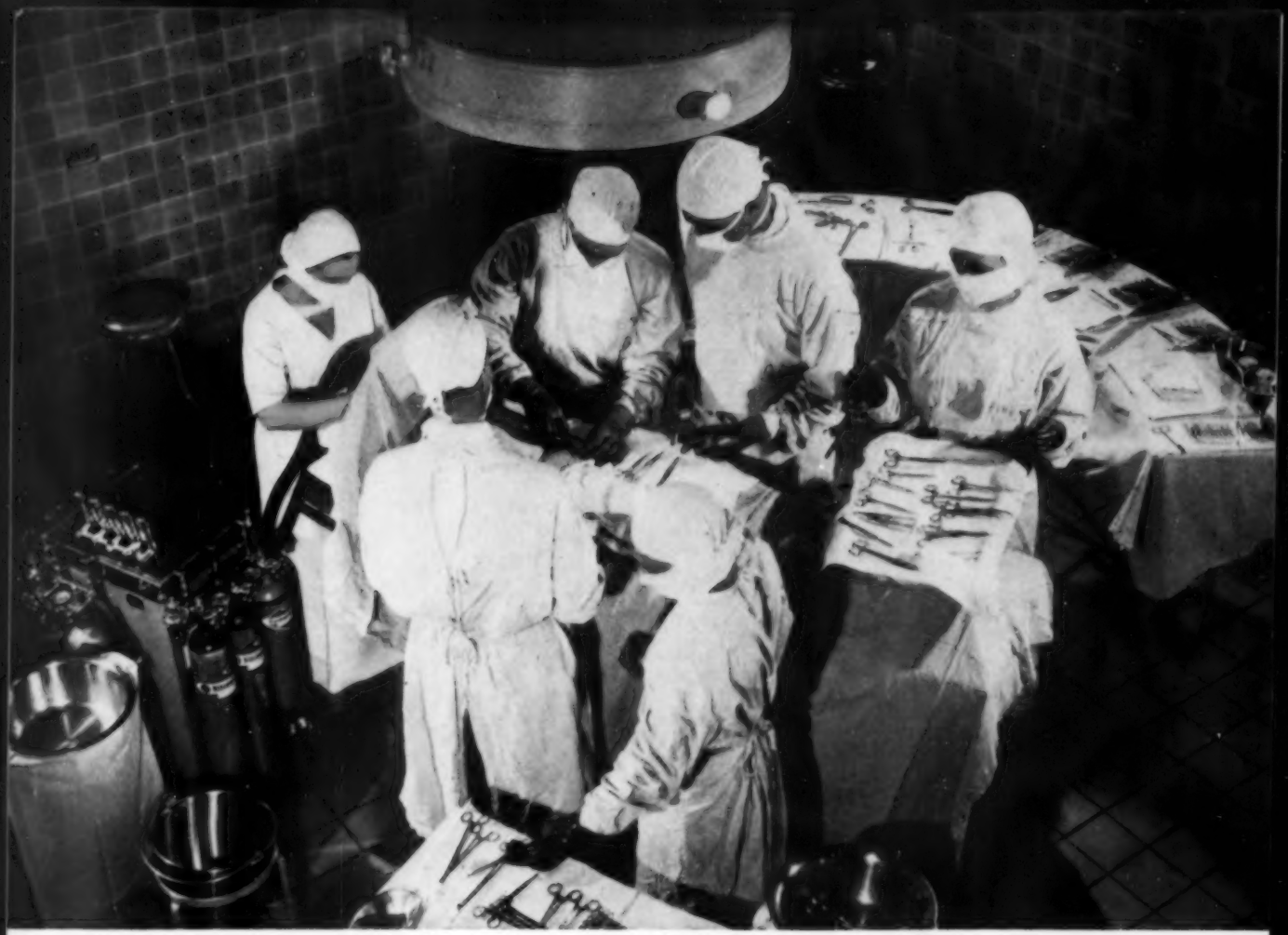

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